2019

Bioterrorism Hardening: An Exploratory Study of EMTs Preparedness and Practices

Ndubuisi Chinemerem Ejike
Walden University

Walden University

College of Social and Behavioral Sciences

This is to certify that the doctoral dissertation by

Ndubuisi Chinemerem Ejike

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

Review Committee
Dr. George Kieh, Committee Chairperson,
Public Policy and Administration Faculty

Dr. Michael Brewer, Committee Member,
Public Policy and Administration Faculty

Dr. Slobodan Pesic, University Reviewer,
Public Policy and Administration Faculty

Chief Academic Officer
Eric Riedel, Ph.D.

Walden University
2019

Abstract

Bioterrorism Hardening: An Exploratory Study of EMTs Preparedness and Practices

by

Ndubuisi Chinemerem Ejike

BS, University of Nigeria, Nsukka, 1990

MA, University of Nigeria, Nsukka, 1993

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Policy and Administration

Walden University

May 2019

Abstract

The 2001 anthrax attacks heightened awareness of the possibility of weaponizing biological agents such as Ebola, anthrax, and smallpox and hence, the Bioterrorism Act of 2002 to prevent biological attacks and reduce bioterrorism threats and vulnerabilities. However, the 2014 Ebola epidemic raised concerns about unpreparedness for bioterrorism within the healthcare community and about secondary infections from healthcare workers. Using Kingdon's conceptualization of multiple streams as the foundation, the purpose of this case study was to explore the nature of bioterrorism threats and the level of preparedness of Emergency Medical Technicians (EMTs) who were involved in the 2014 Ebola epidemic in a New Jersey County for biological attacks and avoidance or reduction of secondary infections. Data were collected from 18 individuals through interviews and from emergency response documents. The data were inductively coded and subjected to thematic analysis. The emergent themes indicated that although there was an abundance of bioterrorism preparedness policies and programs dating back to the 2001 anthrax attacks, the response to the 2014 Ebola epidemic revealed inadequate bioterrorism preparedness practices. The study participants identified insufficient knowledge of bioagents and lack of regular training as factors that prevented enhanced preparedness practices. Participants suggested that improved training opportunities, interagency collaborations, and better funding would improve bioterrorism preparedness practices. The social change implications of this study include increased funding for bioterrorism preparedness to harden EMTs and the creation of public awareness of bioagents for improved 911 calls and emergency response practices.

Bioterrorism Hardening: An Exploratory Study of EMTs Preparedness and Practices

by

Ndubuisi Chinemerem Ejike

BS, University of Nigeria, Nsukka, 1990

MA, University of Nigeria, Nsukka, 1993

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Policy and Administration

Walden University

May 2019

Dedication

It has been a long journey since I began this program. I could not have reached this milestone without the tacit support and encouragement I received from my family especially my wife, Obiamaka, and my children: Mmesooma, Chinemerem, and Chidera. While I pursued this program, they filled the gaping hole my studies created in our family matters. I, therefore, dedicate this project and accomplishment to them.

Acknowledgments

This project would not have been completed without the support and guidance of my Committee members: Dr. George Kieh (Chairman) and Dr. Michael Brewer. Their mentorships were exceptional throughout the entire project. They were candid in their commentaries. I also want to thank the faculty members who taught me one subject or the other. A special thank you goes to my initial Committee Chairman: the late Dr. Ian Birdsall, who guided me at the earlier stage before his sudden death. After his death, Dr. Kieh, then my Second Member stepped up and guided me to the conclusion of the program. All my committee members were excellent in guiding me throughout the dissertation process. Thank you. I will forever remain indebted to you.

I also thank my academic adviser, Ms. La Toya Johnson whose continued advice was of tremendous assistance to me. She was always ready and willing to assist at any time.

Finally, the research participants made the program worth the while with their immense knowledge of the subject matter, assistance and willingness to participate in the study. They gave their time and were candid in their responses to the interview questions. To every one of you, I say “thank you” very sincerely.

Table of Contents

List of Tables v

Chapter 1: Introduction to the Study 1

Problem Statement 9

Purpose of the Study 12

Research Questions 12

Theoretical Foundation 13

Nature of the Study 14

Definition of key Concepts 15

Assumptions 19

Scope and Delimitations 20

Limitations 21

The Significance of the Study 22

Significance to Theory 23

Significance to Social Change 24

Summary and Transition 25

Chapter 2: Literature Review 27

Introduction 27

Organization of the Review 29

Literature Search Strategy 29

Theoretical Foundation 31

Literature Review 35

Pathogens, Bioterrorism, and HCWs' Preparedness....37
Understanding Bioterrorism Preparedness....41
History of Emergency Preparedness, Policies, and Legislations in the United States....48
Summary and Conclusions....91
Chapter 3: Research Design....94
Research Design and Rationale....95
Role of the Researcher....98
Methodology....100
Participant Selection Logic....101
Pilot Study....104
Procedures for Recruitment, Participation, and Data Collection....105
Data Analysis Plan....111
Issues of Trustworthiness....113
Credibility (Internal Validity)....114
Transferability (External Validity)....115
Dependability (Reliability)....116
Confirmability (Objectivity)....117
Ethical Procedures....118
Summary....119
Chapter 4: Findings....121
Introduction....121

Description of the Pilot Study 122
The Setting 123
The Demographics 123
Data Collection and Organization 125
Data Analysis 128
Discrepant data 131
The issues of Trustworthiness 131
Credibility 131
Transferability 132
Dependability 132
Confirmability 133
Results 133
Summary of the findings: 137
Summary 151
CHAPTER 5: CONCLUSION 154
Introduction: 154
Purpose and Nature of the Study 155
Summary of the Findings 155
Interpretation of the Findings 157
Limitations of the Study 178
Recommendations for Future Study 179
Implications for Change 180

Conclusion 183

References 187

Appendix A: Cover Letter 230

Appendix B: Participants' Demographic Information 232

Appendix C: Interview Questions 234

Appendix D: Gatekeeper Information Form 236

Appendix E: Consent and Authorization Form 239

List of Tables

Table 1. Demographic Distribution of Research Participants ……...124

Table 2. Relationship Between Codes, Themes, Categories and Research Questions ...134

Table 3. Graphic Representation of Themed Responses to the Interview Questions ….135

Table 4. Participants Identification Markers ……...137

Chapter 1: Introduction to the Study

The 2014 Ebola epidemic and the varied responses from local and state governments raised public concerns about the capability of healthcare workers (HCWs), especially emergency medical technicians (EMTs), to provide emergency services if pathogens such as Ebola virus disease (EVD) were weaponized by terrorists. Studies showed that the threats of potential bioterrorism attacks are real, and the question was *when* rather than *if* they will occur (Cenciarelli et al., 2015; Fernandez et al., 2011; Hodge, 2002; Rokach et al., 2010; Song et al. 2013). These and other studies pointed to the 2001 terrorist attacks in the United States; the 2001 inhalational anthrax incidents; the increasing number of countries and terrorist groups engaged in active bio-warfare programs; the lack of uniformity, and inadequate training in emergency preparedness within EMTs population in the United States (Barras & Greub, 2014; Dudley & Woodford, 2002; Fernandez et al., 2011; Klein et al., 2016; Poland, Jacobson, Tilburt, & Nichol, 2009; Potter et al., 2012).

EMTs are the first medical responders in disaster situations, including bioterrorism attacks. It is, therefore, necessary to examine HCWs' and EMTs' level of preparedness for bioterrorism in the areas of risk mitigation and response-time strategies (Kabir, Naik, Kumar, & Bhas, 2016). When disasters occur, the immediate challenges EMTs confront are stabilizing patients and transporting them to designated acute healthcare facilities for medical treatments without putting themselves, their families, and their immediate communities at further risks. To protect themselves from pathogens transmitted through bodily fluid, EMTs knowledge of personal protective equipment

(PPE), adequate training, and additional education are necessary (Centers for Disease Control and Prevention (CDC), 2015). Also, transporting patients to acute healthcare facilities poses unique problems and challenges (CDC, 2015).

In 2000, the CDC initiated comprehensive strategic plans with law enforcement and first responders on the need to prepare for possible bioterrorism attacks. The five strategic plans were preparedness and prevention; detection and surveillance; diagnosis and characterization of biological and chemical agents; response; and communication for bioterrorism prevention and readiness (CDC, 2000). Also, in 2002, the United States Government (USG) enacted the Public Health Security and Bioterrorism Preparedness and Response Act (PHSB&R) of 2002, Subtitle A of Public Law 107–188, and the Agricultural Bioterrorism Protection Act (ABPA) of 2002, in order to identify and categorize the biological agents and toxins that have the potential to cause public injury if weaponized. However, Markenson, Reilly, and DiMaggio (2005) indicated that only a small percentage of the 823 participants who returned their questionnaires had been trained in chemical, biological, or radiological terrorism from the health department (6.3%–14.9%). The number, however, increased in other areas of emergency response: 13.5%–22.5% for suspicious case reporting, 15.1%–25.6% for public health emergencies, and 17.3%-31.8% for mandatory infectious disease reporting. These dismal results were years after the PHSBR and ABP Acts of 2002 and the 2003 Hazardous Site Response Act (HSRA), which was designed to train HCWs in emergency disaster responses, including bioterrorism.

In 2010, a U.S. Congressional Report addressed the bioterrorism threat, and President Barack Obama highlighted the threat in a State of Union address (Gottron & Shea, 2011). While the Congressional Report acknowledged the Federal Government's preparedness for a possible bioterrorism attack, it questioned the adequacy of existing mechanisms among other stakeholders involved in emergency response, including state and local governments, and others (Gottron & Shea, 2011). Also, in a 2011 report, the National Science and Technology Council Committee on Homeland and National Security noted the disparities and lack of uniformity and knowledge of chemical, biological, radiological, nuclear and explosives (CBRNE) among HCWs including EMTs. Similarly, other studies (Fernandez et al., 2011; Rickles & Catarious, 2015), highlighted HCWs inadequate training on PPE, inconsistent protocols for handling infected patients, and lack of uniformity in training and education. Protection from pathogens for medical emergency services operators (EMSOs) and EMTs are necessary because of the growing threats of bioterrorism from countries and terrorist groups whose intentions are to inflict maximum harm, destruction, and death on humans, animals, and plants (Burnette, Hess, Kozlovac, & Richmond, 2013; Kadlec, 2013).

Similarly, following the recommendations from the Federal Emergency Management Authority (FEMA), the New Jersey Office of Emergency Management (NJOEM) and the Disaster Management Act of 2000, the New Jersey County Office of Emergency Management (ECOEM) initiated the All-Hazard Mitigation Plan (HMP) to prevent, mitigate, respond to and recover from disasters to guide all emergency responders, including EMTs (ECOEM, 2018). In 2015, the HMP was reviewed to

identify and reduce vulnerabilities to all hazards, including terrorism and infectious diseases (ECOEM, 2018).

Despite the bioterrorism preparedness plans, the 2014 Ebola epidemic showed unpreparedness against Category A biological agents, such as EVD, which has a high mortality rate of between 50-90% and requires appropriate responses and preparedness from HCWs and EMTs (Aquino & Wu, 2011; Sarah, 2016). The lack of adequate preparedness and practices (called *bioterrorism hardening*) within the HCWs and EMTs population pose impediments to effective biodefense (Khan, 2011; Gerstein, 2017; Gostin, Waxman, & Foege, 2015; Sylvia & Danita, 2013).

How prepared are EMTs in the face of the current global bioterrorism threat? What are the community-wide implications of a bioterrorism attack for which EMTs appear ill-prepared? Incidentally, little research has examined the bioterrorism policy, practices, and preparedness for EVD and other cutaneous diseases within the EMTs' population (Barnett et al., 2010; Gerstein, 2017; Lurie, Manolio, Patterson, Collins, & Frieden, 2013). By simultaneously examining EMTs' practices and, preparedness, and identifying lapses, and policy implications, and by using the multiple streams theory (MST), the result of this study will provide data to help policymakers initiate policy changes. The policy changes will, by extension, contribute to improving bioterrorism hardening within EMSO and EMT populations. The bioterrorism hardening within EMSO and EMT population will have further implications for social change through policy formulation for enhanced and up-to-date, community-level bioterrorism preparedness awareness programs. The nature and level of HCWs and EMTs

involvement in bioterrorism policy implementation will form the theoretical basis for the examination of bioterrorism preparedness within the EMT population, as will be discussed in the subsequent chapter.

In this chapter, I discussed the background of the study, provided the need for the study and the history of bioterrorism preparedness before and after the 2001 terrorist and anthrax attacks. The inadequate preparedness and varied responses following the 2014 Ebola epidemic further heightened the need for the study. And the inadequate bioterrorism preparedness makes both the emergency responders and the citizens vulnerable to biological attacks and unable to mitigate the effects of bioagents. I then cover the following topics: the statement of the problem, purpose of the study, the theoretical framework that guided the study, the research questions, nature of the study, definitions of major concepts, the assumptions, the scope and delimitations, the significance of the study, and the implications for social change.

Background of the Study

Global concern for biological terrorism or weaponized pathogens in the modern era dates to the 1925 Geneva Protocol that prohibited the use of biological or chemical weapons in warfare (Pedraza, 2012). In 1967, the World Health Organization (WHO), in recognition of potential biological attacks, issued guidance (updated in 2004) on how to prepare for such incidents to minimize the casualty rate (Jansen, Breeveld, Stijnis, & Grobusch, 2014). The WHO document (*Public Health Response to Biological and Chemical Weapons*) was issued to guide HCWs such as EMTs and national governments on how to respond to incidences of weaponized pathogens on human beings. Again, in

1972, WHO got 103 countries including the United States to sign the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and their Destruction (BTWC) to prevent the use of biological agents as weapons of warfare (Barras & Greub, 2014). Despite the historical global awareness and agreements, the threats posed by bioterrorism persist (Jansen et al., 2014; Weant, Bailey, Fleishaker, & Justice, 2014). Studies show that some countries and terrorist groups, such as Al-Qaeda, have active biowarfare programs and/or have the financial capability to procure biological agents (Cenciarelli et al., 2013; Dudley & Woodford, 2002; Maras & Miranda, 2016).

Kadlec (2013), noted that in the event of a bioterrorism attack, the USG's assessment put the casualty rate at 1.2 million. However, the historical study by Jansen et al. (2014) found that preparedness for bioterrorism by HCWs minimized the casualty level by about 75%. Jansen et al. (2014) undertook a historical overview of pathogens as weapons of warfare and terrorism and the initiatives by the international community to curtail the weaponization of bioagents by both states and nonstate actors. The high rate of casualties has inherent problems and challenges for HCWs, including, EMTs (Maras & Miranda, 2016), and hence the need to harden EMSOs and EMTs because of their frontline roles when pathogens such as EVD are weaponized. The high rate of deaths among HCWs in the four affected countries of Liberia, Sierra Leone, Guinea, and Nigeria during the 2014 Ebola epidemic illustrate the need for bioterrorism preparedness and practices among HCWs. For instance, in 2014, 7.9% of Ebola cases in Guineans, ages 15 and above, were HCWs, which amounted to 42.2 times more than non-HCWs (Grinnell

et al., 2015). Similar higher percentage cases among HCWs were reported in Guinea, Liberia, and Sierra Leone during the Ebola epidemic, with 490 HCWs' dead out of 837 HCWs infected (Maras & Miranda, 2016). This higher percentage rate is an indication of the risk HCWs confront when highly infectious disease (HIDs) strike, as they mobilize to minimize the risk in the community, care for the patients, and/or transport them to AHFs.

In 2001, *Bacillus cereus anthracis* or anthrax, a Category 1 agent, was released in the United States resulting in the death of five patients and many more hospitalized (Poland et al., 2009). The anthrax attack of 2001 and the resultant deaths were wake-up calls that further illustrated the inherent danger of a biological attack (Suk et al., 2011). Also, the lack of uniformity and uncoordinated approach to the EVD epidemic further underscores the need for the study of bioterrorism preparedness of emergency medical workers (Shultz, Baingana, & Neria, 2015).

This study intended to help prepare EMTs for bioterrorism threats and/or attacks by examining their level of knowledge of PPE, training, and education for cutaneous forms of infectious diseases such as EVD. What EMTs can do or what knowledge they need to acquire to adequately show bioterrorism, chemical and nuclear readiness have not been adequately investigated (Fernandez et al., 2011). Furthermore, the critical emergency roles HCWs and EMTs perform require policy initiatives for adequate bioterrorism preparedness and practices such as those proposed by Berger and Moreno (2010). Moreover, EMTs' roles involve not only stabilizing victims of disasters but also transporting them to immediate facilities for further treatments and, this process of transporting disaster victims to HCFs has its unique challenges (CDC, 2015). The CDC

recommends that suspected cases of EVD infections be transported to Ebola assessment hospitals and frontline healthcare facilities, while confirmed cases are transported from Ebola assessment hospitals and frontline healthcare facilities to Ebola treatment centers (CDC, 2014). How EMTs handle these challenges (stabilizing patients and transporting them to HCFs) without jeopardizing community-level safety in the event of bioterrorism attacks are the focus of this study.

In 2000, the CDC organized a Strategic Planning Workgroup (SPW) that studied the bioterrorism preparedness and response strategies involving first responders especially EMT personnel (CDC, 2000). The CDC workgroup noted that critical to bioterrorism preparedness are (a) early detection of biological and chemical terrorism; and (b) adequate awareness of potentially deployable pathogens among frontline health-care providers that could lead to serious illnesses and injuries during and after bioterrorism attacks. However, the 2015 EVD epidemic revealed inadequate preparedness and awareness within the HCW and EMT populations despite many regulations and legislation since the 2001 anthrax attacks (Maras & Miranda, 2016; Shultz et al., 2015).

Studies have shown that (a) adequate knowledge of PPE, (b) education, (c) citizens' participation, and awareness, (d) the perception of bioterrorism threats among HCWs and (e) their readiness to confront biological attacks are essential elements in HCWs and EMTs' practices and preparedness (Clancy, 2008; Sarah, 2016). Following the 2001 incidences of anthrax incidents, the United States. committed vast sums of money to biodefense (Cole, 2012). Despite an enormous financial outlay, the level of

preparedness for possible bioterrorism appears inadequate as evidenced by the haphazard reactions from various state governments to the EVD epidemic (Rickles & Catarious, 2015). Although, research exists on such pathogens as anthrax and H1HI, as well as influenza pandemic preparedness, what past research has not shown is how current EMTs' readiness, practices, and preparedness aligns with the overall community, state, and national bioterrorism programs and policies concerning cutaneous forms of biological agents such as EVD. This study addressed the gap in the literature.

Problem Statement

Despite the over $60 billion spent on biodefense since the anthrax attacks of 2001 and up to the Ebola outbreaks, and the improvement in biodefense and emergency responses, bioterrorism preparedness continued to pose unique challenges for HCWs in the United States (Bitlauer, 2017; Bouzianas, 2009, Cole, 2012, Olsen, 2013; Katz, Attal-Juncqua, & Fischer, 2017). Biological attacks are targeted at humans, animals, and plants to inflict maximum fatality, and cause economic, agricultural, and health problems (Anderson & Bokor, 2012). In 2014, Zaire Ebola Viral (EBOV), a potentially deployable biological agent for bioterrorism, manifested in four West African countries: Liberia, Sierra Leone, Guinea, and Nigeria. EBOV, one of the five known species of EVD that caused thousands of deaths in those West African countries have a high fatality rate of up to 90% (Baize, Pennetier, Oestereich et al., 2014; Choi, Hong, Hong, & Lee, 2015). In the first 9 months of the Ebola outbreak, about 7,388 or 40% of the patients were confirmed dead (Choi et al., 2015).

That EVD reached the United States in 2014 was an indication of its potential as a national and global health threat, and possible weapon for biological warfare. In the event of bioterrorism, HCWs, and their families are at higher risk of infection despite the huge expenditure on biodefense since anthrax (CDC, 2016a; NJDOH, 2014). The higher risk was evident in the case of the 513 HCWs who died during the EVD epidemic in the West African countries out of the 881 infected by November 2015 (CDC, 2016a). EVD, a Category A pathogen, transmitted through direct bodily fluid and blood contact with a sick patient or deceased victim has a high potential for use in biological terrorism in the United States given the successful 2001 anthrax attacks.

Research has shown that only 6% of healthcare facilities in the United States confirmed adequate preparedness to handle Ebola cases (Boscarino & Adams, 2015). Also, there is the challenge of managing large-scale disaster as the response of HCWs to the 2014 Ebola epidemic demonstrated. These were evident in the varied reactions from many states (including New Jersey and Texas) to the EVD epidemic, and they revealed apparent unpreparedness and vulnerabilities within the HCWs' community (Rickles & Catarious, 2015). Rickles and Catarious (2015) attributed the unpreparedness and vulnerabilities to the lack of uniformity and inadequate training for PPE. These vulnerabilities manifested despite the 2011 report of the National Science and Technology Council of the consequences of ill-prepared emergency personnel to CBRNE attacks. Despite the huge expenditure on biodefense, there was apparent unpreparedness and vulnerabilities within the HCW community during the Ebola epidemic. The current study examined EMTs' post-2014 Ebola vulnerabilities, preparedness, and knowledge.

These previous studies and reports also raised the need to explore the policy and political implications regarding EMSOs and EMTs preparedness or unpreparedness for biological attacks in the aftermath of the 2014 Ebola epidemic. Studying EMSOs and EMTs bioterrorism preparedness was important because in the event of bioterrorism, EMTs are the first medical responders who transport patients to acute healthcare facilities despite the challenges involved in the process (English et al., 1999; CDC, 2015). Acute healthcare facilities are designated by the CDC for the management of HIDs such as EVD. So, protecting EMTs from HIDs and bioagents are critical to mitigating the potential effects of bioterrorism on HCWs, and will enhance community-level bioterrorism preparedness and protection.

On one hand, Abatemarco, Beckley, Borjan, and Robson (2007); Galada, Gurian, and Hong (2013); Hughes and Gerberding (2002); Patidar, Singh, Jaiswal, Chaudhary, and Samadi (2013); and Smith and Hewison (2012) conducted studies on inhaled biological agents such as anthrax, policy and collaborative initiatives between federal and state governments and agencies, and their readiness for bioterrorism attacks. On the other hand, Rickles & Catarious (2015) studied EVD preparedness among HCWs. However, to date, little research has examined the bioterrorism preparedness of EMSOs and EMTs regarding their knowledge and use of PPE, training, and education for bioagents such as EVD in New Jersey. The lack of adequate knowledge in the use of PPE, bioagent training, and education among EMTs are hindrances to HCWs safety and community-level bioterrorism preparedness and hardening. Also, little research has examined how PPE, training, and education may enhance EMTs' and community-wide bioterrorism

preparedness and hardening for EVD in the State of New Jersey. This study helped fill the gap in the literature.

Purpose of the Study

The purpose of this qualitative case study was to examine and understand the nature and level of bioterrorism preparedness among EMTs in New Jersey, for cutaneous forms of biological agents such as EVD, and the attendant policy and political implications for inadequate or lack of preparedness. The study sought to identify critical factors that New Jersey's policymakers, and EMSOs management may consider in bioterrorism preparedness within EMTs operations for community-wide bioterrorism hardening. The study's findings will contribute to both EMTs' safety, effective bioterrorism response and hardening, and community-level bioterrorism readiness. Furthermore, this study identified what factors accounted for the inadequate bioterrorism preparedness and response against EVD in 2014: What challenges plagued, and continue to plague, EMSOs and EMTs? To achieve these purposes and address the gap in the literature, I conducted face-to-face interviews with 18 EMTs operating in four EMSOs in the selected County in New Jersey. I also reviewed scholarly works on emergency preparedness and practices among healthcare workers.

Research Questions

The following two research questions guided the study:

1. Are EMSOs and EMTs in New Jersey prepared for a cutaneous form of biological attack such as EVD?
2 And, what are the policy and political implications of lack of preparedness?

Theoretical Foundation

The theoretical framework used for this dissertation was Kingdon's (1984) multiple stream theory (MST). MST's three streams are these: problem stream, policy stream, and political stream. MST originated from the garbage can model (GCM) propagated by Cohen, March, and Olsen (1972). The GCM had four streams: problems, solutions, participants, and choice opportunities. Kingdon, in 1984 narrowed the four streams into three streams and came up with the MST. The major tenets of MST are that the three streams operate independently and at opportune times they must co-exist for policy changes to occur (Alcantara & Roy, 2014; Kattikireddi, Hilton, Bonnell, & Bond, 2014).

The theory addresses policy changes that occur when the streams converge through a window of opportunity, although the streams operate independently. According to Sabatier and Weible (2014), "the problem stream consists of various conditions that policymakers and citizens want addressed," policy streams are projected solutions seeking acceptance; and the political stream "consists of three elements: the national mood, pressure groups campaigns, and administrative or legislative turnover" (p. 32-34). A detailed explanation is discussed in Chapter 2.

MST, for this study, rested on the assumption that, by identifying the vulnerabilities of EMSOs and EMTs (problem) and proffering different possible perspectives for EMTs hardening (policy), policymakers can be pressured to enact laws or policies that will bring about EMSOs and EMTs bioterrorism readiness initiatives (politics). The make-up of the political streams for this study consisted of policymakers at

the state, county, and city levels, and interest groups. MST was primarily designed for analyzing the decision-making process of the federal government, but it has proven a useful tool for analyzing policy changes within state governments and federal agencies (Larkin, 2012). Kingdon used the framework to discuss how the federal government in a policy-making arena advanced policy changes in the context of the interplay of the three streams. MST has also been applied to study local problems. Walhart (2013), in a study, further advanced the argument for multiple streams application in agencies decision-making processes. Walhart (2013) analyzed how MST was applied to improve patients' outcome through problem identification, making the problem a policy issue before policymakers, and influencing the development of new healthcare initiatives.

The theory is germane to this study given the national and global agitation for terrorism and CBRNE preparedness after the 2014 Ebola epidemic. Therefore, the window of opportunity was available to be exploited to create appropriate bioterrorism preparedness policies. The theory also helped the study in examining and proffering strategies for bioterrorism prevention, protection, mitigation and response of EMTs in New Jersey. Therefore, MST is a useful analytical tool for the examination of the operations of EMSOs, the experiences, and vulnerabilities of EMTs, and identification of factors that could help harden them in their responses to biological attacks.

Nature of the Study

The study used the qualitative research design approach to examine the bioterrorism preparedness and practices of selected emergency and protective services (ERP) in the selected County in New Jersey. The target population for data collection

was EMTs who have varied experiences in emergency medical responses in their respective organizations. The data were collected through a face-to-face interview of EMTs selected using the purposeful, snowball sampling technique and the data were analyzed using a thematic approach. Data were also collected from policy documents. Qualitative research was suitable for this study because of its flexibility and probing technique, and the potential for helping discover new leads (Hyett, Kenny, & Dickson-Swift, 2014). The qualitative case study was, therefore, ideal for examining the current level of bioterrorism preparedness, protection, and response (PPR) practices (bioterrorism hardening) and discovering how they may be improved upon given the challenges bioterrorism PPR pose to EMTs' emergency response capability, and uniformity. By undertaking this study and interviewing the study's participants (EMTs) involved in the medical health emergency operations and responses, the study sought to provide an understanding of the extent of PPE knowledge and uniformity in operations within the EMTs' population for bioterrorism hardening.

A case study approach was chosen because it makes room for an exploratory study and in-depth description of the phenomenon using data from various sources, thematically analyzed (Baxter & Jack, 2008). The mode of data collection was a purposeful sampling technique through snowball/chain referral because of its effectiveness in getting information from those who should know (Patton, 2002).

Definition of key Concepts

Bioterrorism: For the purposes of this study, bioterrorism is defined as the intentional act by either a country or terrorist groups (also known as nonstate actors)

often inspired by ideological, national, religious, and political beliefs to inflict harm, death, and create terror, societal disruption and/or economic loss (Jansen et al., 2014). Bioterrorism is not the conventional use of explosives but pathogens such as anthrax, EVD, smallpox, influenza virus on humans, animals or plants to instill fear, harm, illness and death (Wurtz, Grobusch, & Raoult, 2014). The 2001 anthrax incidents in the United States illustrates how devastating biological agents can be if weaponized and the need to invest in preparedness initiatives (Gursky & Bice, 2013). Both anthrax and EVD fall within the CDC, Federal Select Agent Program (FSAP) Category 1 or Tier 1 classification because of their fatality rates (CDC-FSAP, 2014).

Emergency medical technicians (EMTs): EMTs are the pre-hospital emergency medical services providers responsible for attending to patients during disaster situations and transporting them to hospitals (Chen & Yu, 2016; Lin, 2013). EMTs provide basic non-invasive treatment to minimize health risk or harm to the patients, stabilize the patients, and transport them to AHFs (CDC, 2015). They are the direct implementers of government bioterrorism preparedness policies, and, therefore, are most at risk in times of biological attacks as front-line-healthcare workers (CDC, 2000). EMTs fall within what is referred to as emergency and protective services (EPSs) (Sanders, 2013). Other groups within the EPSs are emergency medical responders (EMRs); advanced emergency medical technicians (AEMTs), and paramedics (Garner, Baker, & Hagelgans, 2016; National Registry of Emergency Medical Technicians (NREMTs), 2017).

1. EMRs are first responders with knowledge of life-saving skills. EMRs include firefighters, EMTs and law enforcement officers with basic knowledge of life-saving techniques (Kelly & Hassett-Walker, 2016).
2. AEMTs have a little more knowledge than EMTs. They perform all the activities that EMRs and EMTs do and a little more. They provide minimal and basic but limited advanced medical and pharmacological treatments (National Registry of Emergency Medical Technicians (NREMTs), 2017).
3 Paramedics, on the other hand, have higher skills and provide invasive medical and pharmacological treatment. Paramedics also receive more advanced training of about 1200 hours more than EMTs, to acquire enough knowledge to provide intravenous treatments (Bureau for Labor Statistics, 2019; Waldrop, Clemency, Maguin, & Lindstrom, 2014).

Category A Pathogens: These are pathogens or biological agents that have been classified by the CDC-FSAP as having the capabilities to cause the most severe harms to humans, animals, and plants if used as weapons for biological attacks (CDC-FSAP, 2014). Ebola virus falls into this Category A or what the FSAP also called Tier 1. Other pathogens in this Categories include Marburg Virus, *Bacillus cereus* Biovar *anthracis* (anthrax), Botulinum neurotoxins, and Botulinum neurotoxin producing species of *Clostridium* among others (CDC-FSAP, 2014). Other categories are B and C. Our focus is on EVD. EVD reached the U.S. at the height of the Ebola epidemic in 2014 (Monson, 2017).

Bioterrorism hardening: Bioterrorism hardening for this study is the preemptive preparations for protecting the emergency workers such as EMTs who will be deployed to disaster areas (Kabir, Naik, Kumar, & Bhas, 2016). In other cases, it may involve the entire population. For instance, in 2003, the President Bush Administration began a pilot program to harden 500,000 HCWs through vaccination against the potential use of smallpox as a biological weapon (Allison, 2003). Bioterrorism hardening is all exercises, actions, training, precautionary measures that are put in place to prevent or minimize the impact of biological attacks on targets (Abrol, 2016; Henderson, 2014). One of the actions needed is getting EMTs educated on potential bioagents. For instance, Rokach et al. (2010) discovered in a quantitative study of 76 nurses and physicians, the relationship between the willingness to treat patients during biological attacks and medical knowledge of the pathogen.

Hardening also involves protecting vulnerable targets such as malls, churches, schools and theaters. Target hardening is best illustrated by the measures the aviation industry especially in the US, have put in place to secure airspace and airplanes (Hasting & Chan, 2013). Some of these measures include the introduction of Air Marshalls, the creation of the Transportation Security Administration (TSA), and the x-ray scanning technologies (Hasting & Chan, 2013).

Ebola Virus Disease (EVD): Ebola virus disease is a biological agent that terrorists can weaponize. It is a pathogen that can be transmitted through bodily fluid contact with a patient or a dead victim (Passi, Sharma, Dutta, Dudeja, & Sharma, 2015). EVD, a highly infectious disease (HID) is classified as a Category A pathogen because of

its high rate of fatality of between 50% and 90% (Maras & Miranda, 2016). Other Category 1 pathogens agents include Anthrax (bacillus cereus anthracis), Marburg virus, variola major virus (smallpox), varilola minor virus (alastrim), and botulinum neurotoxins (Cenciarelli et al., 2015). Other species of EVD are Sudan ebolavirus; Bunchbugyo ebolavirus; Restron ebolavirus; and Tai Forest ebolavirus and their symptoms include muscle pains, fatigue, vomiting, diarrhea, fever, weakness and malaise (Choi, Hong, Hong, & Lee, 2015).

Personal Protective Equipment (PPE): PPE are special equipment, respiratory and clothing protective tools designed to minimize the exposure to hazardous materials and agents in the work environment (United States Department of Labor – Occupational Safety and Health Administration, USDOL-OSHA, 2004). Protective equipment includes gloves, masks eye protection and face shields. In 2008, the National Institute for Occupational Safety and Health (NIOSH), enacted Title 29, Code of Federal Regulations (CFR), Part 1910.120 (Hazardous Waste Operations and Emergency Response Standard – HAZWOPER) to ensure the availability of PPE for emergency responders (CDC – NIOSH, 2008). The selection of a PPE depends on the hazard, and the impact the hazard will have on the victims (CDC – NIOSH, 2008; USDOL-OSHA, 2004).

Assumptions

This study made the assumptions that EMTs are the first medical responders in emergency or disaster situations that may not include typical first responders such as firefighters. For instance, in some organizations, some first responders have dual roles such as EMTs and fire-fighters. This clarification is important because first responders is

a loose term applied to all emergency workers, including the medical and military personnel, police, fire-fighters, mobile intensive care nurses, EMTs, EMRs, advanced emergency medical technicians, and paramedics, and disaster rescue volunteers (Garner, Baker, & Hagelgans, 2016). Second, the study assumed that the participants would provide data as truthfully as possible and grant access to their respective organizational policies to make this study more reliable. However, this was not the case as participants were reluctant to provide all needed data due to organizational policies and fear of divulging confidential information. Finally, the study assumed that all EMTs joined the emergency services at different times, received various training, and therefore, had an adequate understanding of the bioterrorism preparedness and practices in their respective workplaces. Although all participants acquired minimum training for certification, there appear to be disparities in the level of their training, knowledge of PPE, and lack of uniformity in training (NSTC, 2011).

Scope and Delimitations

The qualitative approach aligns very well with understanding how multiple stream theory (MST) can be used to examine the potential threat of bioterrorism in New Jersey and the emergency responses from EMTs, who are first medical responders, in the event of possible biological attacks. Data were derived from interviews and government documents. The scope of the study's participants was limited to EMTs in a particular County to the exclusions of other medical emergency responders in the area such as paramedic and mobile intensive care nurses. The research focused on the County EMTs' bioterrorism preparedness because of the county's large population and the organizations'

proximity to potential terrorist's targets such as the Newark train station and the Newark International Airport. However, the study's findings may have the problem of extrapolation to other counties because of local policies and practices that may differ from county to county and city to city.

However, this limitation would still not prevent the study findings from possible applicability to other counties. The study's findings may be applied to understand the bioterrorism preparedness of other HCWs, especially mobile intensive care nurses and other first responders because they are among the first medical responders to disaster areas. For instance, the police and firefighters are among the first to provide first aid treatments to victims when disasters occur (Abatemarto et al., 2007).

Limitations

The overarching intent of this study was to examine and understand the bioterrorism preparedness of EMTs. The aim was to explore the factors that can be put in place for bioterrorism hardening of EMTs and extrapolate the findings to the other emergency responders and HCWs.

The first limitation of this study is that it focused specifically on EMTs in one county to the exclusion of EMTs in other counties who may have more informed views of bioterrorism preparedness and hardening for Category A pathogens such as EVD. An example is the County of Camden, which witnessed the anthrax attacks in 2001.

The second limitation was access to information such as the organizations' emergency response manuals. Access to information such as emergency response protocols are essential to the understanding of bioterrorism preparedness and indeed, all-

hazard emergency response practices. I was under the impression that the study participants would be eager to share information for better bioterrorism response practices and policies.

The third limitation was that the study's participants were EMT populations *outside* the hospital because of the challenges they encounter as the first line of medical defense against HIDs. The study could have gained from the experience of EMTs who operate *hospital-based* emergency response services. Also, the study would have included advanced emergency medical technicians who have greater knowledge in providing basic medical treatment to patients.

Finally, I held the uninformed judgment that EMTs only transport patients to hospitals with no authority or knowledge to offer basic medical treatment to patients. When conducting the research, I was open-minded and never allowed my assumptions to affect follow-up questions or data transcription. However, I established a trusting relationship with the participants which created a good interview atmosphere for the participants to provide accurate and detailed information.

The Significance of the Study

The significance of this study is that it helped bridge the gap in the literature by (a) identifying factors that may contribute to bioterrorism hardening; (b) examining factors that pose challenges in hardening EMSOs and EMTs; and (c) exploring how policymakers can facilitate EMSOs and EMTs bioterrorism preparedness for cutaneous biological agents such as EVD. The study examined the policy and political implications of inadequately hardened EMSOs and EMTs. This research, therefore, contributed to the

field of bioterrorism hardening by proffering a template for emergency response practices by EMTs in the event of biological attacks or release of pathogens. The varied responses during the 2014 Ebola epidemic demonstrated the need for a new approach to bioagent preparedness policy among HCWs. The research findings provided needed data for policy changes in bioterrorism preparedness and emergency response practices in the County used for the study and possibly to other counties in New Jersey.

The CDC recommended the availability of appropriate AHFs, training of HCWs and first responders, and policy guidelines for bioterrorism preparedness (CDC, 2015). However, many AHFs and HCWs, including EMSOs and EMTs, appear not to conform to the CDC's guidelines for bioterrorism preparedness (NSTC, 2011; Rickles & Catarious, 2015). Although some states' agencies have developed collaborative initiatives for bioterrorism hardening in response to the CDC's recommendations (Smith & Hewison, 2012), little research has been conducted to examine the EMSOs' and EMTs' bioterrorism preparedness, protection, and response for EVD in New Jersey. By simultaneously examining EMTs practices and preparedness, by identifying lapses and policy implications, the results of this study provided urgently needed data for policy changes that would improve the bioterrorism preparedness and practices of EMSOs and EMTs.

Significance to Theory

The study contributed to the advancement of the theoretical knowledge in bioterrorism hardening among HCWs for HIDs or biological agents because of the inherent threat they pose as possible weapons for biological attacks (Aghaei & Bagheri-

Nesami, 2013; Jensen et al., 2014). Previous studies (Abro, 2016; Clancy, 2008; Gursky & Bice, 2013; Hunter, Yang, Crawley, Biesiadecki, & Aragon, 2013; Katz, Attal-Juncqua, & Fischer, 2017) have addressed government initiatives and HCWs preparedness for inhaled biological agents such as anthrax, use of PPE and their willingness to respond to bioterrorism attacks. The qualitative case study will help advance the theoretical knowledge of bioterrorism through policy formulation, training and education of EMTs in acquiring adequate knowledge of various infectious pathogens, their characteristics, prevention strategies, and uniformity in bioterrorism response practices.

Significance to Social Change

HCWs, especially EMTs in their roles as emergency responders, have limited time to make decisions about caring for their patients while protecting themselves from harm, infection and possibly infecting their colleagues (Ahmad et al., 2016). It is, therefore, critically important that EMTs have bioterrorism preparedness readiness, training, and PPE knowledge to protect themselves. This study is expected to bring about attitudinal change, increased awareness and knowledge of biological agents among EMTs and the public. The recognition of biological agents would increase stricter application of precautionary measures when responding to emergencies, especially in this age of the proliferation of biological agents.

The collateral social benefit is that EMTs' bioterrorism response readiness will protect the community from possible contamination and risk through secondary infection. The study will bring about improvement to EMSOs and EMTs bioterrorism preparedness

and practices while accounting for local needs and challenges. These improvements in bioterrorism preparedness and practices have implications for social change through policy formulation for enhanced community-level bioterrorism preparedness programs in the local communities and the county as a whole.

Summary and Transition

Studies have shown that HCWs knowledge of PPE, training, and education are critical to an effective bioterrorism preparedness (Abatemarco et al., 2007; Clancy, 2008; Kabir, Naik, Kumar, & Bhas, 2016; Smith & Hewison, 2012). Critical to this preparedness plan is uniformity across the levels of government in disaster response plans, and EMTs' awareness and knowledge of the potential bioagents. Following the varied responses from various governments in the United States during the 2014 Ebola epidemic, there was the need to examine bioterrorism preparedness of HCWs (Maras & Miranda, 2016).

I used Kingdon' MST to explore the nature of bioterrorism threats given that terrorist groups are exploring the means to weaponize biological agents and the failed response to the 2014 Ebola epidemic further exposed the vulnerabilities of HCWs to such threats. The study noted that despite the huge financial commitments to bioterrorism preparedness after the 2001 terrorist and anthrax attacks, bioterrorism preparedness among HCWs continued to pose challenges. Also, few studies have addressed these challenges in bioterrorism hardening and the continued threats from possible biological attacks. The qualitative study's findings were expected to help fill the gap in the literature

by providing an understanding of the nature of the bioterrorism preparedness for cutaneous diseases such as EVD.

I examined the problems and challenges confronting EMTs, identified the factors for bioterrorism hardening, and explored how policymakers could help facilitate the bioterrorism hardening processes using the theoretical framework of MST. In addressing these challenges and preparedness, the study sought to answer the research questions: How prepared are EMTs for cutaneous diseases, and what are the policy implications? The study's findings also sought to help increase understanding of the growing field of bioterrorism preparedness. The findings, if implemented, may help policymakers formulate policies and programs that would not only increase safety practices among EMTs, but increase bioterrorism response readiness, and community-wide preparedness in New Jersey. The findings can be extrapolated to other counties in New Jersey, and nationally because when EVD struck, it was a national rather than New Jersey and Texas problems. The study would help institute uniformity in EMTs' policies and practices, increase EMTs' knowledge of pathogens and their characteristics, and mitigate secondary infections.

In chapter 2, the literature review helped this study identify the challenges of bioterrorism preparedness and policy actions that have been explored in the past. The review of the literature also assisted in narrowing the study problem. To achieve this goal, Kingdon's MST facilitated the study's understanding of the problem, the policy choices, and policy implementation options for bioterrorism hardening.

Chapter 2: Literature Review

Introduction

Bioterrorism preparedness and practices continued to pose unique challenges for HCWs in the United States as was evident in the varied responses to the 2014 EVD epidemic despite the policies and programs, and funding since the 2001 anthrax attacks for biodefence initiatives (Cole, 2012; Wurtz, Grobusch, & Raoult, 2014). For instance, in response to the 2014 – 2015 Ebola outbreaks, the United States Congress allocated about $5.4 billion for preparedness and response both internationally and locally (Katz, Attal-Juncqua, & Fischer, 2017). However, the varied responses from various state governments during the Ebola epidemic raised public concerns about the preparedness of HCWs for cutaneous forms of biological agents such as EVD, anthrax, and smallpox if weaponized by terrorists (Gonsalves & Staley, 2014; Shultz, Baingana, & Neria, 2015).

The purpose of this qualitative case study was to examine EMTs' bioterrorism response practices and challenges and to identify factors that may influence policy makers in formulating policies geared towards biodefense preparedness and practices (bioterrorism hardening) for EMTs in New Jersey. This study was significant because HCWs are often at higher risk of contracting any epidemic disease not known at the time of the epidemic (Walker & Whitty, 2015). The higher risks within HCWs have often resulted in more deaths within the HCW population relative to the general population, as was evident in the 2014 EVD crisis in the West African sub-region (Fasina, Adenubi, Ogundare, Shittu, Bwala, & Fasina, 2015). Also, EMTs exposure to any pathogen may jeopardize community-wide public healthcare safety. Therefore, this study would help

mitigate the risk of secondary infection among the EMT population and reduce potential community-wide infection. Mitigating the secondary risk requires preparedness. Preparedness or countering bioterrorism if efficiently planned and executed can reduce casualty rates to 75% based on a simulation conducted by the Center for Nonproliferation Studies (Jansen, Breeveld, Stijnis, & Grobusch, 2014).

In this chapter, I emphasize the relationship that the study's theoretical framework had with the research problem and questions. The theoretical framework for this study was Kingdon's MST. MST illustrates the inter-connectivity of problems, competing solutions for these problems, and the politics involved in making policy decisions. The basic tenets of this theory are the idea that, as the existing problems gain the attention of policymakers, competing solutions begin to emerge, policymakers acknowledge the problem, and agree with the proposed solution which they turn into policy (Cairney & Jones, 2016).

There is an abundance of literature on bioterrorism preparedness policies and plans since the anthrax attacks (Gursky & Bice, 2013; Lall et al., 2017; Smith & Hewison, 2012). The literature reviewed showed the level of involvement of emergency medical workers and HCWs in general in bioterrorism mitigation, and the impact of past and current bioterrorism preparedness plans. However, the 2014 Ebola outbreaks and the responses to the confirmed cases in the United States showed that all the years of bioterrorism preparedness plans, programs and policies were inadequate (Stratton, 2014). Stratton (2014), while acknowledging the failure of political leadership, laid the ultimate blame on the healthcare community for the unpreparedness. The study, however, failed to

acknowledge the pivotal roles that government policies and preparedness plans play in establishing emergency response protocols and building critical public confidence (Rosoff, Siko, John, & Burns, 2013).

Organization of the Review

The review of the literature began with an examination of the theoretical basis for the study. This study explored the need for further research on EMTs bioterrorism preparedness as threats from lone-wolf terrorists and terrorist groups, and bioterrorism intensify. The subsequent sections of this chapter illustrated the literature review strategies, the theoretical framework for the study, and the segments covered in the literature review. The review of the literature section included the in-depth examination of the history of bioterrorism; pathogens, bioterrorism, and HCWs' preparedness understanding of bioterrorism preparedness, history of emergency preparedness, policies, and legislation in the United States, participants' knowledge of cutaneous diseases, the importance of bioterrorism preparedness, EMTs' training, readiness and hardening, threat assessment, vulnerability assessment, and bioterrorism preparedness in New Jersey. Finally, the chapter reviewed the main issues covered in the literature. The essence of the review of the literature was to understand how the existing literature aligned with this study, identify the gap in the literature, and help address the literature gap.

Literature Search Strategy

The literature review focused on scholarly works on the questions of potential weaponization of pathogens for terrorist attacks, the origin of bioterrorism, understanding the meaning of bioterrorism preparedness, the preparedness of EMTs for bioterrorism,

and policies about bioterrorism preparedness and response in post-2001 anthrax attacks and post-Ebola epidemic. The major source of the literature review was from the Walden University library databases: *Academic Search Complete*, *EBSCOhost*, *Sage Premier*, *ProQuest Central*, *ProQuest*, *Political Science Complete*, *Google Scholars*, *Thoreau: search multiple database*, peer-reviewed journals retrieved from websites. Other sources of the literature review included government agencies' documents and policies from the Center for Disease Control and Prevention (CDC), Department of Homeland Security (DHS), the New Jersey Department of Health (NJDOH), and a county Office of Emergency Management.

The keywords used in sourcing the study materials were *biological agents, threats; disaster preparedness, vulnerabilities, disaster; target hardening, terrorist signaling; bioterrorism, response*, *preparedness*; *bioterrorism preparedness, qualitative case study research; Ebola, Healthcare Workers, fatality; Ebola, Response, United States; emergency medical technicians*; *bioterrorism and Ebola virus disease*; *bioterrorism, pathogens, policy*; *qualitative, healthcare workers*; *bioterrorism, preparedness response, policy*; *John Kingdon, multiple stream framework*, *problem broker, policy and bioterrorism*. The literature review showed the abundance of literature on inhalational pathogens such as anthrax following the 2001 anthrax attacks, the subsequent bioterrorism preparedness initiatives, and the safe handling of pathogens in laboratories. There was also an abundance of literature on nurses and physicians' bioterrorism training and preparedness in a hospital environment. However, there is the scarcity of research on the protocols and practices involved in transporting patients to

acute care facilities and the risks EMTs confront and the challenges in responding to disaster victims.

The key search terms that resulted precisely in relevant and current articles from Google Scholar and Thoreau: Search multiple databases include *multiple stream theory; bioterrorism, preparedness, Europe initiatives*; *bioterrorism, anthrax, United States*; *anthrax, history, United States*; *policy; multiple stream theory, bioterrorism; bioterrorism, Ebola, vulnerability*; *bioterrorism, policies, EMTs*; *infectious disease, bioterrorism, United States*; *The Ebola Virus and the threat of bioterrorism*; *Bioterrorism, qualitative research, healthcare workers, training, uniformity*. Other keywords that were useful in the iterative search for current and relevant articles include: *Bioterrorism*; *Bioterrorism, preparedness, policy*; *anthrax, United States*; *bioterrorism, vulnerability, risk*; *bioterrorism, preparedness, response, policy; Emergency response, Hurricane Sandy*; *Ebola, healthcare workers, fatality*; *Bioterrorism preparedness and response act of 2002*; *Infectious disease, threat assessment, bioterrorism*; *bioagents, diseases, bioterrorism*; *bioterrorism, Acts 2002*; *bioterrorism, Ebola, preparedness*; and *bioterrorism, emergency, responses*.

Theoretical Foundation

The theoretical foundation for this study was John Kingdon's multiple stream theory (Kingdon, 1984). MST emerged out of Kingdon's inquisition to understand how problems get solved through policies in the contest of competing solutions, and the factors that influence decision-making at the national level. Knaggård (2015) viewed MST as a useful tool for agenda-setting but noted that often studies using the theory laid

less emphasis on the problem stream of the theory. MST origin was traced to the work (garbage can model – GCM) of Cohen et al. (1972) as Brunner (2008) observed. GCM has four streams: problems, solutions, participants, and choice opportunities (Brunner, 2008). Kingdon narrowed these streams to three: Problem, policy, and politics.

However, for MST to be a useful analysis for policy changes, there must be an awareness of the existence of a problem usually after a disaster or an incident such as the threat of bioterrorism and the question of EMTs' preparedness to respond to possible bio-attacks (Hayle, 2015; Hoeijmakers, De Leeuw, kenis, & De Vries, 2007; Katikireddi, Hilton, Bonell, & Bond, 2014). The next step will be to seek for solutions to the problem (policy stream). Finally, a window of opportunity such as a political change must exist for both the problem and policy streams to converge and bring about desired policy changes (Sabatier & Weible, 2014). Put differently, the problem stream refers to the policy problems that need attention, the policy stream relates to the many policy solutions from many sources including policymakers, experts and pressure groups, while the politics stream pertains to the happenings within the government circle including change in political leadership and pressures from public opinion that create the window of opportunities for policy changes (Howlett, McConnell, & Perl, 2015).

The utility of the MST lies in the interconnectivity of a problem (problem stream), competing solutions proposed by interest groups (policy stream), and existing events or the public dispositions to the events (political stream) and the policymakers' understanding of their constituents' dispositions (Hayle, 2015). The theory addresses policy changes that occur when the streams, though operating independently, converge

through a window of opportunity. The basic tenets of MST are as follows: The presence of issues that the public and policymakers want addressed (problem stream); the various existing programs and competing solutions seeking acceptance (policy stream); and the three elements: the national mood, pressure groups campaigns, and administrative or legislative turnover that compete in the political stream (Sabatier and Weible, 2014). The theory provides the theoretical foundation for analyzing the context and interplay of the three streams in which policymakers make policies.

Many studies have used MST to address societal problems and policymakers have used it to develop policies to solve problems. Avery (2004), used the theory to illustrate how mismatching the streams can have larger policy implications. The study showed how policy entrepreneurs mismatched the problem and a policy solution to a wrong political stream following anthrax 2001 attacks. Avery (2004) argued that the mismatch arose by labeling bioterrorism a security issue rather than a public health concern. The result of the mismatch, Avery (2004) noted was that the United States lost a window of opportunity to bring about health policy reforms that would have addressed health problems related to the anthrax bio-attacks. Could a similar mismatch be responsible for the poor handling of the Ebola epidemic in the US?

In another study, Brunner (2008) applied the theory in the case study of Germany's 2007 adoption of the low-carbon economy proposed by the European Union (EU). The EU adopted the Emissions Trading Scheme (EU ETS) in 2005. The ratification of the ETS occurred despite the oppositions from interest groups within EU. One of such interest groups was the chemical producers. In any event, the new policy emerged

because there was an awareness that a problem existed that needed a solution; suggestions on how to go solving the problem followed; and the window of opportunity presented when German Chancellor became the EU President (Brunner, 2008). Germany was forced to follow the wind of change sweeping the world for carbon reduction measures. Brunner (2008) demonstrated the utility of MST, although, the study recommended using it in combination with other approaches. MST was also applied to examine local problem issues. Supporting the application of the theory to local problems, Walhart (2013) advanced the argument for MST application in agencies' decision-making processes. Walhart (2013) analyzed how MST was applied to improve patients' outcome through problem identification, making the problem a policy issue before policymakers, and influencing the development of new healthcare initiatives.

MST is also a useful theoretical framework because of its adaptability to many public policy issues areas and changes within subnational governments and federal agencies and not only for analyzing national government policy issues (Cairney & Jones, 2016; Larkin, 2012). Kingdon used the framework to discuss how the federal government in a policy-making arena may advance policy changes in the context of the interplay of the three streams. In this study, MST helped this qualitative case study identify bioterrorism preparedness challenges or problems, threats, vulnerabilities, key players in bioterrorism preparedness, emergency medical responses and policy making, and who or what posed impediments to identifying factors necessary for bioterrorism hardening.

MST, for this study, rested on the assumption that, by identifying the vulnerabilities of EMSOs and EMTs (problem) and proffering different possible

perspectives for EMTs hardening (policy), policymakers can be pressured to enact laws or policies that will bring about EMSOs and EMTs bioterrorism readiness initiatives (politics). The make-up of the political streams for this study consists of policymakers at the state, county, and city levels, and management of EMSOs.

The importance of the theory to the current study was in its ability to help examine and understand the "objective condition" that opened policy windows for solutions to solving the inadequate bioagent preparedness among HCWs (Hayle, 2015). MST was, therefore, a useful tool in the examination of the bioterrorism preparedness and practices among EMTs in New Jersey, especially in a post-Ebola epidemic. The existing literature demonstrated the need to examine bioterrorism preparedness among HCWs after the Ebola epidemic. The MST as a theoretical framework was a useful tool to examine the challenges of bioterrorism preparedness and emergency response practices (BT/ERPs) for cutaneous disease such as Ebola. As a result, the interview and research questions were framed to get adequate information from the research participants to reflect on the current practices and identify areas of improvement for the safety of EMTs and the community. Finally, MST was a useful analytical tool for examining problems, exploring available policies/solutions, and the politics involved in making policies choices. Overall, the theoretical framework, the research questions and the methods of inquiry assisted the study in examining and understanding the threats posed by bioterrorism, the vulnerabilities, and the need for bioterrorism hardening.

Literature Review

A Historical Overview

This section began with a description of the history of bioterrorism, and emergency service operations in the United States. Bioterrorism has existed for centuries dating back to the 14th century BC (Barras & Greub, 2014). Bioterrorism, the intentional introduction of infectious diseases or biological agents into food, water or air (Maras & Miranda, 2016) or for biological warfare (use of cadavers and contagions, and pollution of wells for enemy armies) could be traced to 600 B.C through to the 20th century (Taylor, 2015). In the 14th Century, during the Roman civilization and as the wars raged, water supplies were poisoned with dead rodents; and in the 1700s, British soldiers used blankets infested with smallpox to attack French soldiers (Patidar, Singh, Jaiswal, Chaudhary, & Samadi, 2013).

It was suspected that infectious diseases were deployed in the World War I and that prompted the 1925 Geneva Protocol to curtail the use of bioagents as weapons for warfare (Cenciarelli et al., 2013). Commonly used bioagents are anthrax and smallpox, and they were deployed during World War I and World War II (Barras & Greub, 2014; Berger & Moreno, 2010). Other historical incidents, attacks or warfare that utilized bioagents included Anthrax and Bubonic plague deployments of 1937 by Japan's Unit 731, the 1984 Rajneeshee Religious Salmonella typhimurium attack, 1995 Aum Shinrikyo Cult sarin gas of 1995, and the 2001 anthrax attacks in the United States (Tambunam, Parikesit, &, Saputro, 2014). And the threats of, and actual biological attacks have progressively increased since 1970 (Greub & Grobusch, 2014).

Pathogens are threats to both HCWs and the community because they are easier to procure and can be transmitted from a human to another human covertly (Maras and

Miranda, 2016). Hence, EMTs capability to identify when biological attacks happen is critical to their understanding of how to contain the pathogens and avoid further risk to themselves and the community (Cenciarelli et al., 2013).

In 1976, another highly infectious disease (HID) Ebola viral hemorrhagic fever (VHF) or Ebola virus disease (EVD or Ebola), and a potentially deployable bioagent with a fatality rate of between 50% and 90% first manifested in Sudan (Maras & Miranda, 2016; Passi et al., 2015; Taylor, 2015). In 2014, the disease manifested in West African and the United States (CDC, 2016b). And some studies (Caro et al. 2015; Cenciarelli et al. 2015; Maras & Maranda, 2016) have noted the potentials of Ebola as a biological agent and the difficulty in identifying its' manifestation as was the case with the Liberian (Tim Duncan) who was treated in a Texas hospital. The responses to Mr. Duncan's case further heightened the public concerns of the state of preparedness in the United States for an epidemic or release of biological agent despite the PAHPR Act of 2013 (Monroe, 2014).

Pathogens, Bioterrorism, and HCWs' Preparedness

Pathogens are threats to both HCWs and the community because they are easier to procure and can be transmitted from a human to another human covertly (Maras & Miranda, 2016). Hence, HCWs' and EMTs' capability to identify when biological attacks happen is critical to them understanding how to contain the pathogens from further risking themselves and the community (Cenciarelli et al., 2013). Multiple studies (Burnette, Hess, Kozlovac, & Richmond, 2013; Hasan, 2014; Klein et al., 2016; MacIntyre, 2015; Menrath, Tomuzia, Frentzel, Braeunig, & Appel, 2014; Oladimeji et

al., 2015; Rickles & Catarious, 2015) agree on the bio-threats from terrorist groups and the lack of adequate training, education, and uniformity among EMTs and HCWs. MacIntyre (2015) recognized the increasing threats posed by the scientific developments and the accessibilities of terrorist groups and state-sponsors of terrorism to potential bioagents especially dual-use research of concern (DURU). Another issue of concern was EMTs' knowledge of potential bioagents and insider threats from research biologists. MacIntyre (2015) further argued that these issues are compounded by the lack of adequate training and policies and recommended bioterrorism response strategies against unnatural pathogens. In another study, Menrath et al. (2014) noted the high probability of bioterrorism but acknowledged the lack of clear assessment of the threats posed by bioagents. Menrath et al. (2014) used the semi-quantitative risk evaluation approach. The authors measured the risk using probability - impact analysis factors including access to the bioagents, production probability, and historic use. The usefulness of the study was the usage of ranking to develop an effective bioterrorism response strategy. However, the study unlike the study by MacIntyre (2015) did not recognize the difficulty in evaluating emerging or new infectious diseases.

Similarly, the study by Oladimeji et al. (2015) went beyond the theoretical preparedness for an emerging disease to use the 2014 Ebola incidence to assess the preparedness, practices, and knowledge of HCWs for such potential bioagents. The cross-sectional design study in Nigeria used stratified sampling technique and conducted a semi-structured interview process to assess the occupational health hazards HCWs face in their daily activities. The study assessed respondents' knowledge of Ebola and their

precautionary measures to avoid personal risks and community-wide infections during the 2014 Ebola epidemic. The study found discrepancies among HCWs knowledge of Ebola and inadequate and ineffective response practices. The study's finding suggested that higher knowledge of Ebola and better practices were located among medical doctors. This qualitative case study focused on EMTs, a sub-group of HCWs, who are not as well educated as medical doctors, and the study was conducted post-Ebola epidemic.

Although the qualitative research study by Hasan (2014) aligned largely with the study by Oladimeji et al. (2015) they, however, deferred from each other because Hasan (2014) emphasized more on both state and nonstate actors developing hybrid biological agents such as black pox (a hybrid of smallpox and Ebola). The study pointed to the on-going hybrid development of bioagents in countries such as Syria, Iran, and North Korea who are in coalition with terrorist groups in the Middle East region. The usefulness of the study by Hasan (2014) to this case study was essentially on its recommendations for pre- and post-bioterrorism preparedness responses and practices, and training of medical staff including emergency workers given the existence of active bioweapon programs by state and nonstate actors.

Murali, Ordóñez, and Dessouky (2012) noted that a major preparedness response strategy and practice is the question of distributing strategic national stockpile to address huge demands in the event of a large-scale biological attack. Such preparedness included training medical personals such as EMTs. Another preparedness response strategy would involve a partnership between public environmental health and emergency preparedness and response (EPR) programs in collaboration with local communities of which

emergency medical workers are major components (Gamboa-Maldonado, Marshak, Sinclair, Montgomery, & Dyjack, 2012). Although Gamboa-Maldonado et al. (2012) focused on environmental health and EPR strategies for emergency workers, the findings could be used in response to biological attacks if EMTs have adequate knowledge of bioagents and are well trained. The study found that environmental health professionals are not trained in disaster emergency and bioterrorism responses.

The study by Potter et al. (2012) mirrored the study by Murali, et al. (2012) but focused on strategic national stockpile distribution preparedness and strategies among states in response to potential disaster situations such as epidemics. The study used the CDC recommended strategic national stockpile scores to assess states' preparedness for influenza and stockpile distribution within a reasonable time frame. The CDC study found disparities in training, exercising and distribution of medical and pharmaceutical supplies among states. Potter et al. (2012) recommended increased funding towards improving the scores of the low-scoring states to improve the national preparedness for strategic national stockpile distribution. The study is important because it reflected the disparities in the States' Ebola responses when the disease emerged in the US. EMTs, though charged with emergency medical response responsibilities lacked adequate and uniform training and education (Klein et al., 2016; Rickles & Catarious, 2015).

In an earlier study, Keranen (2011) found that the reemergence of formally eradicated potential bioagents such as smallpox was a source of concern and indicated the need for preparedness and planning. The reason Keranen (2011) adduced for the potential reemergence of the bioagents are the available stockpiles in various laboratories.

However, the importance of the research is in its acknowledgment of diverse views on the possibility of bioterrorism attacks: high and low probabilities. Despite the polarization, Keranen (2011) noted the overwhelming view among policymakers and the general population that the chances for biological attacks were higher than lower, and, therefore, the urgent need for bioterrorism preparedness policies and practices.

Klein et al. (2016) survey design analyzed 403 completed and returned questionnaires on the use of a triage system to assess mass casualty incident in emergencies response among emergency medical providers. Triage knowledge (protocols, transportation of patients, and life-saving interventions) among EMS personnel is essential for the mitigation of risk in emergencies. Although the study found the importance of triage experience for medical emergency response, it recommended a follow-up qualitative research on what influences EMS initial triage decisions. The strength of the Klein et al. (2016) was in using triage assessment to get HCWs and EMTs ready for mass casualty incident and transporting patients to healthcare facilities. Second, a similar assessment strategy may be used to evaluate bioterrorism preparedness of EMTs.

Understanding Bioterrorism Preparedness

Preparedness or public health emergency preparedness and response (PHEPR) presupposes getting ready for the unknown happening, preventing the occurrence of emergency situations, and planning to respond appropriately to mitigate the effect of the emergency (Hedman, Knutsson, Ansell, Radstrom, & Rasmusson, 2013; Nemane, 2012; Revere et al., 2011; Washington State Department of Health, 2016). Bioterrorism, on the

other hand, is the intentional release of pathogens by state actors and nonstate actors using micro-organism (pathogens) to create terror, cause injuries and death (Streatfield, Kushnir, & Yusibov, 2015; Tambunan, et al., 2014). For bioterrorism to happen, there must be what Cenciarelli et al. (2013) referred to as two actors or activities: pathogens in the forms of bacteria, viruses or toxins, and means of dissemination.

Bioterrorism preparedness requires unique knowledge acquisition on bioterrorism management; is a continuous process and the knowledge needs to be updated intermittently. Hedman et al. (2013) while describing bioterrorism preparedness focused on a different area of bioterrorism: agroterrorism. A subset of bioterrorism, agro-terrorism is the use of bioagents to attack animals and plants. The study's approach to bioterrorism preparedness against agro-terrorism was a diagnostic preparedness response strategy against overt and covert bio-attacks.

In a study on building community resilience in a large urban county, Plough et al. (2013) noted that after 9/11 and the subsequent post-2001 anthrax incidents, emergency preparedness took center stage in public healthcare practice. Some of the elements of the emergency preparedness initiatives of the CDC PHEPR included building preparedness capabilities for emergency responses and responders and HCWs having knowledge of potential bioagents and their respective characteristics. The strength of Plough et al.'s study rested on its focus on community resilience through community cohesion, trust, and acquiring and transferring knowledge, similar to the study conducted by Gamboa-Maldonado et al. (2012). Though both studies (Gamboa-Maldonado et al., 2012; Plough et al., 2013) did not particularly address bioterrorism preparedness in-depth, they were

significant in providing an understanding of the way forward for EMTs and HCWs' bioterrorism preparedness and knowledge acquisition because EMTs operate in local communities.

Improving preparedness capabilities and bioterrorism responses are major concerns within the public health system because HCWs and emergency responders appear unprepared for disasters or bioterrorism response (Whetzel, Walker-Cillo, Chan, & Trivett, 2013). An important population of HCWs for bioterrorism preparedness and responses is EMTs because they are often the first emergency workers in mitigating the impact of disaster including bioterrorism.

Therefore, this study examined bioterrorism policies and practices of EMTs in the selected County to understand how it would contribute to improving bioterrorism preparedness, responses, and practices in New Jersey. The study also has implications for EMTs safety and community-wide protection in the event of biological attacks by terrorists. There is was equally the need to update EMTs' knowledge of PPE, potential bioagents regularly, and characteristics of bioagents to be able to prevent or mitigate the impact of the bioterrorism and loss of lives among EMTs' population and the wider community.

The literature review further demonstrated the importance of bioterrorism preparedness policies, and the need to harden EMTs through uniformity in training, education, and response strategies and practices. EMTs' hardening would have the added implications for community-wide bioterrorism preparedness in New Jersey. Studies indicated that EMTs face numerous challenges in disaster responses including lack of

uniformity in training, inadequate training, poor knowledge of potential pathogens' characteristics, and inadequate response strategies or practices (Gilmore, et al., 2007; Taschner, Nannini, Laccetti, & Greene, 2016).

Taschner et al. (2016), used a qualitative case study approach and snowball technique and interviewed 12 participants on emergency responders' preparedness in the hospital environment. Taschner et al. (2016) used the systems framework for catastrophic disaster response to analyze the problems inherent in medical emergency responses in hospitals and the need for standardized training. The study recommended further research on standardized training for HCWs and emergency response because emergency response practices are dynamic. The evident failure of the emergency preparedness plans during the Ebola epidemic supports the findings and recommendations of Taschner et al. (2016). The strength of the Taschner et al. (2016) was in its recommendation for continued training for emergency responders. Unfortunately, the study did not include bioterrorism preparedness and response in the study. Taschner et al. (2016) demonstrated the literature gap in the field of bioterrorism hardening among HCWs and especially EMTs.

After the 2001 anthrax attacks and 2014 Ebola epidemic, many studies examined bioterrorism preparedness among HCWs and government preparedness policies, and found lapses and unpreparedness (Khan, 2011; Smith & Hewison, 2012; Staiti, Katz, & Hoadley, 2003; Steed, Howe, Pruitt, & Sherrill, 2004; Taylor, 2015). Khan (2011) informed that HCWs and the United States governments were ill-prepared for the 2001 anthrax attacks. The American Academy of Family Physicians (AAFP) and the Agency for Healthcare Research and Quality (AHCRQ) further noted that public health care

providers were largely unprepared for bioterrorist attacks and disasters (Abraham et al., 2012). Abraham et al. (2012) conducted five tabletop scenarios to assess the level of bioterrorism preparedness among HCWs including EMTs, and how they can benefit from practically simulated scenarios on preparedness, threats, and potential biological attacks.

The study (Abraham et al., 2012) was a departure from most studies on bioterrorism preparedness because the participants' pool of HCWs were from different healthcare backgrounds and were mixed in each tabletop scenario. The problem with this study was that the result might not have accurately reflected preparedness in each HCWs' group such as EMTs. This assumption was because each group of HCWs, depending on the services they provide, operate differently and at different stages of the healthcare or disaster responses. For instance, EMTs largely function in a pre-hospital environment, unlike other HCWs who function in a hospital environment.

Interestingly, the study by Markenson, Reilly, and DiMaggio (2005) examined the effects of inadequate training of EMS providers for bioterrorism, chemical, and radiological terrorism. Markenson et al. (2005) observed that EMTs and paramedics received few and inadequate CBRN training (6.5%) compare to other disaster response areas. Studies conducted by the National Science and Technology Council Committee (2011) and Rickles and Catarious (2015) supported the findings by Markenson et al. (2005). Although other areas of disaster response training performed better, they were nonetheless inadequate despite the 2001 anthrax attacks and the significant resources committed to biodefense (Cole, 2012; Markenson et al, 2005). Similarly, in 2007, Abatemarto et al. (2007) researched with 18 certified EMTs that showed lack of

preparedness protocol among EMTs in New Jersey during the anthrax attacks of 2001. The study noted that the lack of bioterrorism preparedness put the EMTs in high-risks of exposure in the event of bio-attacks and potentially create a community-wide bioterrorism risk. My qualitative case study built on the study by Markenson et al. (2005) and following the 2014 Ebola epidemic with a focus on EMTs' bioterrorism preparedness practices including uniformity in training, education, response protocols, and knowledge of potential bioagents and their characteristics.

The inadequate CBRN training for operators of EMS has not changed despite the 2001 anthrax attacks as Markenson et al. (2005)'s longitudinal survey sampling study showed. The report of AAFP and AHCRQ shared similar conclusions (Abraham et al., 2012). Similarly, following the 2014 Ebola epidemic, Maras and Miranda (2016) examined the epidemiology of Ebola, and its possible weaponization, and further noted the lack of preparedness for large-scale Ebola attack or outbreak and inadequate training of HCWs for bioattacks or infectious diseases. Though Markenson et al. (2005) and Abraham et al. (2012) helped our understanding of the state of HCWs bioterrorism preparedness; they did not conduct small studies on cutaneous forms of pathogens that have potentials for weaponization unlike Maras and Miranda (2016). On the other hand, Gamboa-Maldonado et al. (2012), examined how environmental health and emergency preparedness response (EPR) can help build the enabling environment for community disaster responses. Gamboa-Maldonado et al. (2012) demonstrated the important roles local communities and emergency responders play in disaster management and recommended doing so in collaboration with other levels of government. The qualitative

study was conducted with semi-structured interviews approach and non-probability sampling methods that involved 14 study participants. The study found that little attention had focused on the training needs for bioterrorism responses and practices. The study's findings were particularly relevant to my study because it supported the need to further examine and understand the training needs of EMTs in bioterrorism response and identify factors for instituting best emergency response practices.

Rokach et al. (2010) conducted a qualitative inquiry that examined the relationship between the HCWs having accurate and up to date knowledge of a disease (anthrax) and their willingness to respond to disaster situations. The inquiry concluded that HCWs with less knowledge of an infection disease are more likely to doubt their ability and therefore less willingness to respond to bioterrorism. Despite the finding of the research, the study had one critical limitation: It focused on non-contagious disease. Nonetheless, the study was significant to my qualitative case study by its recommendation for further studies that would examine how PPE can enhance HCWs' willingness to treat biological attack victims.

Though Fernandez et al. (2011)'s quantitative survey study highlighted the training of EMS operators, the research focused on terrorism and disaster preparedness with little attention to biological, chemical and nuclear preparedness. The study noted that insufficient funding for terrorism and emergency preparedness and lack of uniformity in education were key issues militating against adequate preparedness among EMS workers despite the finding that there was a positive relationship between training and emergency responses. Fernandez et al. (2011) concluded by recommending

performing real-world disaster assessment of the impact of training on disaster response performance and preparedness. However, the study was limited by the high number of respondents who provided insufficient responses because of the method of data collection: mail-in survey technique. In another research, Henderson (2014) discovered that training on counterterrorism measures among first responders focused on chemical weapons and explosive devices with little examination of biological weapons and the control of outbreaks of infectious diseases.

In conclusion, Abraham et al. (2012); Cole (2012); Fernandez et al. (2011); Gamboa-Maldonado et al. (2012); Henderson (2014); Maras and Miranda (2016); Markenson et al. (2005); Rokach et al. (2010); and Taschner (2016) contributed to knowledge by highlighting the need to further examine and understand how HCWs especially EMTs can be further hardened for potential biological attacks. These recommendations were significant given the varied, incoherent, and inadequate Ebola epidemic response from the various level of governments in the United States (Maras and Miranda, 2016; Stratton, 2014).

History of Emergency Preparedness, Policies, and Legislations in the United States

Threats of potential biological attacks from some nations and terrorist agents have increased since the 2001 terrorist and anthrax attacks (Gamboa-Maldonado et al., 2012; Khan, 2011; May, Jochim, & Sapotichne, 2011). Cenciarelli et al. (2013) and Maras and Miranda (2016) conducted studies that underscored the continuous research by terrorist groups to acquire bioweapons despite the 1925 and 1972 Conventions and protocols that prohibited the use of bioagents. Hence the increased policies, programs, and legislation

on bioterrorism preparedness in the United States since the anthrax incidents in 2001 and the increased need for collaborations between the levels of governments (Gamboa-Maldonado et al., 2012).

The 2001 terrorist and anthrax attacks raised public concerns and brought about increased terrorist and bioterrorism policies, programs and legislation. In 2002 after the anthrax attacks, the Bush Administration enacted the Bioterrorism Act: The U.S. Public Health Security and Bioterrorism Act (U.S. BTA) of 2002 (Cinturati, 2014). The U.S. Bioterrorism Act marked a strategic shift towards bioterrorism prevention, preparedness, response, mitigation, and recovery. However, before the 2002 BTA, there were other Acts created to prevent the use of bioagents in the United States. Examples of the Acts enacted for bioterrorism preparedness and response plans included the 1995 Biological Weapons Antiterrorism Act (BWA Act) and The Defense Against Weapons of Mass Destruction Act (DWMD Act) of 1996. Also, in 1995, the USG promulgated the Presidential Decision Directive No. 39 (PDD-39) for bioterrorism preparedness following the sarin gas attack in Japan, and the Russian Government manipulation of smallpox for potential bioterrorism (Avery, 2004). In 1996, the PDD-39 was followed by the DWMD Act, Public Law 104-201 to prepare and train state and local agencies against WMD (Seiple, 1997). The DWMD Act recognized the inadequacy of emergency responders for chemical, biological, radiological and nuclear agents and materials. Despite these Acts, the 2001 anthrax incidents occurred with the resultant casualties and injuries: 5 deaths and 17 injuries (Bush & Perez, 2012).

In 2000, following the rise of infectious diseases such as variola virus, the contagious causative agent of smallpox, the CDC Strategic Planning Workgroup (CDC-SPWG) initiated bioterrorism preparedness strategies. The CDC-SPWG, noted the importance of early detection in bioterrorism preparedness as did the study conducted by Seiner et al. (2013). The group added that preparedness for bioterrorism depends on the federal, state, and local governments with a strong public health system, especially for first responders who are most at risk. The CDC-SPWG also recognized the critical roles emergency workers perform at the local government level in disaster management, mitigation, recovery and response, and their important roles when responding to strange illnesses and injuries (CDC, 2000). Seiner et al. (2013) conducted a quantitative study that used polymerase chain reaction (PCR), a detection system to identify genetic characteristics of bioagents. The study and the findings of the use of PCR (PCR: minimized errors in pathogen identification) are significant because they have the potentials to help mitigate secondary infections.

Although the issue of weaponized HIDs had been of concern to successive United States governments, it was President Bill Clinton's Administration that elevated bioterrorism preparedness to a national security priority (Fidler, 2003). Grundmann (2014) discussed preparedness after the 2001 anthrax attacks among the levels of government and the challenges preparedness posed to HCWs in detecting the nature and characteristics of pathogens and in responding to biological agent dissemination or attacks. Although, public health emergency preparedness (PHEP) for HIDs and other hazards pose challenges to HCWs, Khan et al. (2015), however, informed that effective

PHEP and response practices are critical to mitigating the community-wide impact of all-hazards emergencies. Hence, the understanding of the preparedness and response readiness of EMTs is important.

The U.S. BTA of 2002 was in response to the 2001 anthrax attacks, and aimed to prevent, prepare and respond to future acts of bioterrorism (Nemane, 2012). Additional goals of the 2002 BTA included proper training through the conduct of exercises to ascertain the response readiness and capabilities of emergency responders, and the public health system (United States Congress, 2002). Are EMTs in New Jersey knowledgeable enough, adequately educated and trained to meet these national preparedness requirements of the 2002 BT Act? I explored this question which aligned with the research questions for this study.

In 2003, the USG issued the Homeland Security Presidential Directive-8 (HSPD-8) for the DHS to create a national domestic preparedness plan for human-made and natural disasters. The results of the HSPD-8 directive were the 2007 National Preparedness Guidelines: National Preparedness Vision; National Planning Scenarios; Universal Task List, and Target Capabilities List (Fry-Pierce & Lenze, 2011). The Target Capabilities List (TCL) contained 37 capabilities for which all levels of government, communities and the private sector must collectively engage in for adequate disaster response. Although the TCL focused on terrorism and disaster response capabilities, the capabilities list can be extrapolated to bioterrorism preparedness and response capabilities (Fry-Pierce & Lenze, 2011). Despite these changes in the government bioterrorism

program, policies, and preparedness plans, Fry-Pierce and Lenze (2011) noted that there was still inadequate preparedness for potential biological attacks.

Also, in 2004, the U.S. Congress enacted the Project Bioshield Act of 2004 (P.L.108.276) and earmarked $5.6b for stockpiling drugs to combat bioterrorism (Monroe, 2014; Gottron, 2014). Project Bioshield was enacted for bioterrorism preparedness countermeasures against bioagents including Bacillus anthracis, Ebola virus, and Variola virus. The United States government classified these agents Bacillus anthracis (anthrax), Ebola virus (hemorrhagic fever) and Variola virus (smallpox) as posing substantial national threats (Gottron, 2014).

In 2011, the Obama Administration enacted the Presidential Policy Directive-8 (PPD-8) to strengthen HSPD-8. The PPD-8 that replaced the Bush Administration's HSPD-8 was enacted to identify potential threats and create integrated approaches for mitigating terrorism threats (Caudle, 2012). These Presidential Directives further reaffirmed the need for preparedness programs and policies. The PPD-8 also developed national preparedness capabilities for preventing, protecting against, mitigating the effects of, responding to, and recovering from "those threats that pose the greatest risk to the security of the Nation" (Department of Homeland Security (DHS), 2015). The PPD-8 also targeted pathogens that have been weaponized in the past and those that have the potentials for use as biological weapons. Again, in 2013, the Congress re-authorized the Project BioShield procurement program with The Pandemic and All-Hazard Preparedness Reauthorization Act PAHPR Act (P.L. 113-5) and allocated $2.8b for the 2014 – 2018 fiscal years. Despite the BTA of 2002, the Project BioShield of 2004, the

HSPD-8, PPD-8, and the PAHPR Act, when EVD struck, the U.S. health emergency response systems appeared unprepared and inadequate.

Biological weapons are pathogens that have potentials for conversion into biological agents (Ananthula, Sama, Pamukuntla, & Adepu, 2012; Anderson & Boker, 2012). They include smallpox, anthrax, Ebola, influenza, and Botulism. These pathogens pose greater risks than conventional attacks by explosives because they are often covert and difficult to detect before they become fatal (Gunaratne, 2015). The covert mode of disseminating pathogens make them both challenging and dangerous for HCWs. Using the Presidential Policy Directive-8 (PPD-8) as a guide, one approach to mitigating the effect of weaponized biological agents is knowing their respective attributes (Patidar et al., 2013). Although the threat of bioterrorist attacks has heightened and protection against bioagents and detecting the agents are also difficult, but HCWs' ability to recognize, manage diseases associated with bioterrorism events and stay abreast of new developments would help mitigate the effects of bioterrorism (Southern Illinois University, School of Medicine, 2017).

How knowledgeable are EMTs of cutaneous biological agents' characteristics? This study explored this question as one of the preparedness practices for bioterrorism hardening. Although some studies (Hayman, 2010; Galada et al. 2013) demonstrated that hardening HCWs, EMTs, and first responders are the first step towards saving lives and reducing casualties in bio-attacks, none examined EMTs' preparedness against cutaneous forms of pathogens in New Jersey.

The Literature on Knowledge of Cutaneous diseases or HIDs

The terrorist attacks in the United States on September 11, 2001, by the terrorist group, al Qaeda, and the subsequent anthrax attacks shattered the aura of invincibility and (bio)terrorism preparedness and also created global apprehension (Toomey & Singleton, 2014). The terrorist group's attacks on the New York World Trade Center, the Pentagon in Washington DC, and Pennsylvania and the 2001 anthrax attacks jolted policymakers and brought about the 2002 Bioterrorism Act (Cinturati, 2014). Also, the 2001 anthrax attacks raised further concerns that other bioterrorist attacks were imminent (Hunger, 2014). Significantly, the 2001 terrorist attacks showed the extent to which terrorists would go to create panic and destabilize the socio-economic well-being of any nation. Potential weapons for bioterrorism are highly infectious diseases (HIDs), and they include Ebola, anthrax, and smallpox. The European Network for Infectious Diseases (EUND) described HIDs as diseases that can be transferred from persons to persons, can cause death, and cause serious hazards that would require unique control measures (Schilling et al., 2009).

The terrorist attacks galvanized not only the USG but also world and regional leaders and organizations. For example, following the 9/11 and anthrax attacks, the European Union (EU) initiated bioterrorism preparedness programs and health security framework that focused on prevention, preparedness, and response strategies (Elbe, Roemer-Mahler, & Long, 2014). The EU commission's bioterrorism preparedness program was similar to the U.S. Bioterrorism Act and other subsequent U.S. bioterrorism programs and policies such as the pharmaceutical stockpiles for antiviral medications (Elbe et al., 2014). The EU bio-program viewed bioterrorism readiness as a public health

policy issue that required adequate responses to bio-incidents in the following areas: prevention, protection, first responders' readiness, prosecution, surveillance, research, recovery (Casale, 2010). Other aspects of the EU bioterrorism preparedness initiatives like the U.S. BTA was the EU CBRN Action Plan that sort to put into action the CEN Workshop Agreement 15793: 2011, (CWA 15793) also known as the "Laboratory bio-risk management", and the development of emergency response templates (Sundqvist et al., 2013). Canyon (2009) conducted a ten self-assessment survey of public health professionals' bioterrorism preparedness and competencies in Australia. The research showed that clinicians in Australia were ill-prepared for biological attacks which had serious implications for HCWs safety, management of biological attacks, and prevention of the endangerment of the larger population. Canyon (2009)'s quantitative study and the EU initiatives were indications of global apprehension of potential bioterrorism. Despite the apprehension, few studies addressed EMTs' preparedness and community-wide readiness for possible biological attacks.

In another work, Berger and Moreno (2010) conducted a study on healthcare professionals' bioterrorism response based on two possible policy approaches. Berger and Moreno discussed the two bioterrorism response approaches namely, coercive model and cooperative model. The coercive model includes quarantines, confinements, mandatory vaccinations, and other measures public health workers may choose to contain the effects of biological attacks. An example of a coercive model is the Model State Emergency Health Powers Act (MSEHPA). The cooperative model involves the use of information to educate public health workers and respect for civil right even as public

officials attempt to contain the disaster. Berger and Moreno (2010) concluded that although the cooperative model is more effective in bioterrorism response, a combination of both models would be most appropriate.

Berger and Moreno (2010) focused on bioterrorism preparedness, prevention, response and mitigation from the point to view of policymakers' bioterrorism policy. The study as compelling as it was, did not address how HCWs and EMTs fit into any of the approaches or a hybrid of both. In a cross-sectional inventory study that adopted the portfolio analysis approach, Shelton et al. (2012) examined 1,593 projects and discovered that over 66% of those projects focused on biological threats. The projects involved non-classified national health security research that was mostly sponsored by the National Institute of Allergy and Infectious Diseases. The authors contributed to the knowledge about the national approach to bioterrorism preparedness which further justified the need to explore bioterrorism hardening and preparedness among emergency workers. The study also highlighted the need to involve the private sector in national security matters. Non-hospital based EMTs are critical aspects of the private sector participation in emergency medical response.

Smith and Hewison (2012) explored the existential threats of bioterrorism and the roles and vulnerabilities of hospital nurses. The study found that despite the U.S. bioterrorism preparedness policies, programs, and legislations hospital nurses were inadequately trained and prepared. The study noted that the inadequate bioterrorism preparedness had implications for bioterrorism mitigation and suggested that bioterrorism training should be conducted along with infection control education. Besides the nurses'

roles in the ER department, mobile intensive care nurses often work alongside EMTs in a prehospital environment and administer advanced treatment to disaster patients. Although Smith and Hewison (2012) focused on hospital nurses, it excluded mobile intensive care nurses and EMTs who often are first medical responders to disaster situations. This qualitative study addressed this gap in the literature.

Aghaei and Nesami (2013) similarly conducted research that focused on nurses but on nurses' education and its impact on their bioterrorism response and mitigation. Aghaei and Nesami (2013) demonstrated that education was effective in making nurses bioterrorism ready: Before bioterrorism education, 67.7% had low-knowledge, and after education, 98.5% had good knowledge of bioterrorism. The study also found a similar effect of education and training on physicians. Again, Aghaei and Nesami (2013) and Smith and Hewison (2012) omitted critical chain in bioterrorism preparedness: EMTs, who are the healthcare population most at risk when responding to bioterrorism. Barnett et al. (2012) conducted a cross-sectional qualitative study of 8 urban and rural local health departments (LHDs) and 2993 LHD workers' (LHDWs) willingness to respond to an all-hazard emergency scenario. Part of the emergency scenario involved bioterrorism. The study found that all-hazard preparedness initiatives have different impacts on willingness to respond among emergency local and urban HCWs. For instance, the research finding suggested that an "effective scenario-based risk awareness assessment" has a positive impact on increased knowledge and a higher level of willingness to respond. First responders were part of the study, but like the tabletop scenario study by Abraham et al. (2012), they were not a good representative of EMTs' capability and

willingness to respond to anthrax bioterrorism (a bioagent). The study very much acknowledged this limitation. Barnett et al. (2012)'s study was, however, significant because LHWs showed a higher rate of willingness to respond towards bioterrorism than other categories including radiological hazards.

The significance of these studies (Aghaei & Nesami, 2013; Barnett et al., 2012; Smith & Hewison, 2012) was their recommendations for further training of HCWs and the inclusion of bioterrorism preparedness into their curriculum. But their respective studies included a little or insignificant number of EMTs as study participants, and thus making extrapolating their findings to EMTs emergency response practices difficult.

In another study, Kabir, Naik, Kumar, and Bhas (2016) noted that knowledge of bioterrorism preparedness among HCWs is important if the effects of weaponized pathogens are to be mitigated among the HCWs in the event of biological attacks. The study focused on medical students' knowledge and awareness of bioterrorism agents. The result showed the need to include bioterrorism preparedness in the medical students' curriculum. For example, the medical students had a higher knowledge of bioterrorism than biosecurity. This study supports the other studies (Aghaei & Nesami, 2013; Hoeppner, Olson & Larson, 2010; Kabir, Naik, Kumar & Bhas, 2016; Smith & Hewison, 2012) that demonstrated the importance of adding bioterrorism preparedness in the curriculum and education of HCWs including nurses, emergency medical workers. Hoeppner, Olson, and Larson (2010) created bioterrorism (BT) and emergency response (ER) competencies program for HCWs. The longitudinal study found that after six months of learning 64.1% had acquired bioterrorism competency and 63.5% were

competent after twelve months of BT/ER learning program. Similarly, the quantitative study conducted by Kabir et al. (2016) found the need to incorporate bioterrorism preparedness in the medical curriculum.

On the other hand, the study by Wang, Luangkesorn, and Shuman (2012) was significant to the current study because it focused on the relationship between information received by emergency responders and their commanders and the decisions they make when responding to disasters. Decisions made during disasters have critical implication on EMTs response effectiveness, safety, and community-wide disaster containment. Part of the decisions is determining how and where to transport patients (such as acute healthcare facility) after stabilizing them.

The roles of evacuating and transporting patients are more problematic if it involves mass casualty incidents (MCI). To address this scenario, Wang et al. (2012) developed an agent-based simulation model to assess patients' emergency needs before taking appropriate actions. The quantitative study contributed to knowledge in modeling emergency scenario but limited in its focus on all hazard scenario. However, the study's observation that specialized casualties be treated at so-dedicated hospitals, and its' recommendation that hospitals reserve some beds in reserved units are appropriate for bioterrorism attacks victims. Such specialized beds or hospitals for bioterrorism patients appeared inadequate in the United States during the Ebola epidemic, and that demonstrated unpreparedness for HIDs.

The varied responses from the states to the Ebola epidemic appeared to reveal unclear and inadequate infectious disease response protocols and practices put in place

after the 2001 anthrax incidents. For instance, Taylor (2015), noted the failure of the disaster responses to anthrax, and the lost opportunity to have used the Ebola epidemic as a 'test run' and "'tabletop exercise' to assess the existing protocols for responding to covert bioweapons attacks." A test run could have reviewed the rigorous decontamination process especially with handling PPE and determining whether additional training was needed (Taylor, 2015). This study again focused on the hospital environment and nurses in the emergency department and excluded a critical part in the emergency response chain: Disaster response in a pre-hospital environment by EMTs. Poor knowledge of the decontamination process and PPE was evident during the Ebola epidemic and posed a community-wide risk. Caro, Puro, Fusco, Capobianchi, and Ippolito (2015) and Wiwanitkit (2014) aligned with the studies conducted by Taylor (2015) and Passi et al. (2015). Both Caro et al. (2015) and Wiwanitkit (2014) underscored the gap in knowledge whenever a new disease emerges or re-emerges and noted the need for continuous preparedness measures.

In a different but related study, Caro et al. (2015) illustrated how the 2009 H1N1 epidemic was mislabeled the swine flu as instances of lack of preparedness and knowledge gap among healthcare officials and workers. The gap in knowledge and challenges persisted despite the over twenty years of bioterrorism preparedness policies and funding (Caro et al., 2015). Wiwanitkit (2014) viewed the Ebola epidemic as a potential global threat that was made more challenging due to the lack of biosafety level 4 in many developing countries, possible misdiagnosis, and inadequate funding for diagnosis and treatment. In a related study, Caro, et al. (2015) noted that since the Ebola

began, new standards for managing patients have been developed and updated including donning PPE, handling of patients and dead patients, waste management, and medical staff safety in accordance with the infection prevention and control (IPC) protocols. The study was conducted in a hospital in Italy after a 50-year-old patient was infected, treated and released. However, EMTs who are critical to the mitigation of epidemics or biological agents were not part of the studies. How knowledgeable are EMTs in the selected County to these enhanced level 4 biosafety protocols updated during and after the 2014 Ebola epidemic?

The Ebola virus disease is a potential bioagent that poses a challenge to HCWs and has national health implications (Lohmus, Janse, Goot, & Rotterdam, 2013). The challenges manifested during the 2014 Ebola epidemic. Therefore, adequately preparing HCWs should be a national priority. No matter the sources of bioagent infection (natural or bioterrorism) EMTs should be well-prepared to mitigate the impact. Inadequately prepared HCWs and EMTs have community-wide health implications because contagious pathogens have incubation periods by which time the symptoms would have become potentially deadly in the community (Passi et al., 2015).

Passi et al. (2015) observed that part of the challenge in containing Ebola included acquiring knowledge of the virus, institutional failings of the health system, and lack of experienced HCWs. Particularly, Passi et al. (2015) informed that delay in identifying cases of virus or bioagent infection and transporting samples such as blood or serum from Ebola patients to the laboratories posed challenges as well. The study, a historical account of the disease, brought out another critical dimension to bioterrorism

preparedness: The question of managing and transporting tissues or blood samples for laboratory testing and analysis. Passi et al. (2015) further suggested the following preparedness protocols for EVD: Knowledge of PPE, patients' transportations or handling in hospitals, equipment handling and processing, and environment sanitization among others. Although the study focused on scenarios in a hospital setting, the study's preparedness protocols may be extrapolated outside of the hospital to EMTs disaster response practices.

During the anthrax attacks, first responders were challenged by the inadequate training and understanding of areas contaminated by the anthrax exposure (Galada et al. 2013). Galada et al. (2013) further noted that although some bioterrorism preparedness programs have been developed since the 2001 anthrax attacks, those programs have not been implemented uniformly across the levels of government. The quantitative study focused on first responders with the majority drawn from the fire department (55) out of 70 study participants. EMTs were among the other first responders categorized as others (7). The study has some limitations: First, it has a small number of EMTs that could make the study not representative of the EMT population. Second, the study addressed only inhalation anthrax while excluding dermal and ingestion exposures. Third, other biological agents were not considered in the study. This study built upon the Galada et al. study because it focused on a dermal exposure bioagent such as Ebola. Also, my study was conducted in a post Ebola epidemic period. The findings may help address bioterrorism preparedness in the event of biological attacks.

In a study, Waldrop, Clemency, Maguin, and Lindstrom (2014) noted the critical roles that Prehospital emergency providers such as EMTs perform and decisions they also make when responding to emergency calls that include the end of life patients. These critical roles and decisions involve transporting the patients to the hospital emergency rooms or in the case of bioterrorism attacks to AHFs (Waldrop et al., 2014; CDC, 2015). Although the study by Waldrop et al. focused on the end of life patients, the findings demonstrated the importance of education, training, and established protocols and practices to emergency responses.

To achieve the goal of bioterrorism preparedness, the CDC identified five areas for strategic bioterrorism readiness: preparedness and prevention; detection and surveillance; diagnosis and characterization of biological and chemical agents; response; and communication. The start-up point was to categorize these pathogens. The CDC classified potential infectious disease that can be weaponized into three categories (Categories A, B, and C.) and, also because of ease of dissemination (Das & Kataria, 2010). The CDC classifications of the viruses illustrated their respective potentials as bioagents capable of weaponization; the severity of the pathogens if used for bio-attacks (Gunaratne, 2015). Category A virus represents the highest threat to humans, animals, and plants both in mobility and mortality (Anderson & Boker, 2012; Gunaratne, 2015). The categories and the pathogens in Category A include viral hemorrhagic fever (diseases caused by viruses such as Ebola and Marbug), plague, smallpox, and anthrax. Category A is so classified because the viruses in this category have the characteristics that give them weaponization capabilities. These characteristics include infectiousness and symptoms;

dissemination methods; pathogenesis and etiology; availability of prophylaxis, and weaponization capability (Gunaratne, 2015). Category B include cholera, ricin, and salmonella; Category C: are emerging pathogens including Nipah virus and Hanta virus (Kenar & Baysallar, 2010; Patidar et al., 2013). Despite these initiatives by CDC, the 2001 anthrax attacks occurred with the resultant fatalities and injuries.

Gunaratne's comparative qualitative study focused on the uniqueness of Ebola as a bioagent in comparison to anthrax and smallpox that have previously been used in biowarfare during the World War 1 by Germany (Gunaratne, 2015). However, the potential pathogenesis of EVD appear not fully understood, and neither have HCWs understood how to respond to potential bio-attacks with EVD.

Pathogens as potential Bioagents

Pathogens are disease-causing agents (Méthot, 2015). Ebola, anthrax, and Smallpox are among the pathogens that the U.S. Working Group on Civilian Biodefense, and other studies listed as most likely to be deployed for bioterrorism by terrorist groups or state-sponsored biological attacks (Anderson & Boker, 2012; Cenciarelli et al., 2013; Gunaratne, 2015). The reason advanced for this assumption was the possible ease of acquiring and putting bioagents into use by terrorist groups and state sponsors of terrorism, and the time frame before the disease is identified (Sinha, & Singh, 2016). By the time a pathogen is identified, it would have spread to many more victims in the community causing panic, socio-economic disruptions, and deaths (Anderson & Boker, 2012; Cenciarelli et al., 2013).

Menrath, Tomuzia, Frentzel, Braeunig, and Appel (2014) provided yet another way to measure the likelihood of an agent becoming weaponized. The study noted the ranking system of identifying levels of risk measured by the probability of using an agent and its impact on a population (probability + impact = risk). The study, however, warned that the ranking is for management decisions for enacting policies and legislation and enhancing preventive measures and for bioterrorism emergency responses. Menrath et al. (2014)'s comparative ranking formula was important to this study because it helped assess the pathogens most likely to be deployed especially with the ease of procurement and dissemination (Cenciarelli et al., 2013). As Cenciarelli et al., (2013) further noted, relative to other forms of terrorist attacks, biological weapons are least expensive to procure per area size: Bioweapons – 1$/km, $600/km (chemical), $800/km (nuclear), and $2,000/km (conventional armaments) based on a 1996 North Atlantic Treaty Organization (NATO) assessment. In a related historical account of the history of bioterrorism, Ózsvári, Kasza, and Lakner, (2015) emphasized that identifying pathogens constitute a difficult problem and therefore, more challenging to control because of the time involved in identifying the bioagents. Also, the effect of biological attacks from 100 kg anthrax-spore bomb can inflict casualty rate of about three million whereas, those from megaton hydrogen bomb can cause about up to two million casualties (Ózsvári et al., 2015).

In summary, Cenciarelli et al. (2013), Gunaratne (2015) as well as Menrath et al. (2014) studies, were significant in helping our understanding of pathogenesis and etiology and weaponization of HIDs. The studies also exposed the threats posed by

bioagents and terrorist groups using the pathogens as did the study by Anderson and Boker (2012). Biological agents are pathogens (smallpox, anthrax, Ebola, influenza, and Botulism among others) that have potentials for conversion into biological weapons; are often deployed covertly and, pose serious challenges to HCWs (Ananthula, et al., 2012; Anderson & Boker, 2012; Gunaratne, 2015). Similarly, Also, the threat of biological attacks and the difficulty of developing mechanisms for detecting bioagents and protecting the community from harmful application of biological research especially in this age of globalism is real (National Threat Initiative, 2015).

The 2011 Presidential Policy Directive-8 (PPD-8) was one approach used to mitigate the effect of weaponized biological agents through HCWs knowledge of bioagents' attributes (Patidar et al., 2013). Other approaches included instituting standardized training and uniformity in emergency responses among HCWs especially after the 2001 anthrax attacks and the 2014 Ebola epidemic (Hunger, 2014; Taylor, 2015). Review of the literature showed the abundance of studies on bioterrorism threats, policies on bioterrorism preparedness, evidence of failed policies and emergency medical responses, and literature gap on Ebola and/or hybrid Ebola pox as potential bioagents (Caro et al., 2015; Eva 2012; Passi et al., 2015; Taylor, 2015; Wiwanitkit, 2014).

All the studies significantly demonstrated the need for preparedness by national agencies and HCWs for possible bioterrorist attacks and contributed to knowledge by providing the need for studies on HCWs' preparedness response and practices for possible biological attacks. The need was more so for EMTs.

Anthrax

Bacillus anthracis, popularly known as anthrax (cutaneous, inhalation and gastrointestinal) is highly resistant to environmental changes and can be easily acquired and used as bioagents (Cenciarelli et al., 2013). The study by Li et al. (2017) on the anthrax incidences in China indicated a 98% prevalence rate of the cutaneous form of anthrax within the Chinese farmers and herdsmen population. Anderson and Bokor (2012) further noted that anthrax was classified as a Category A pathogen because its' cutaneous form has a high mortality rate and requires unique preparedness response from HCWs including EMTs. Li et al. (2017) and Anderson and Boker (2012) studies were significant to my study because they agreed on the high rate of cutaneous forms of anthrax (95% of all anthrax cases) acquired through direct contact with the spores or the bacilli. These studies (Anderson & Bokor, 2012; Li et al., 2017)) also revealed the potential human and economic implications of cutaneous anthrax if weaponized and without a corresponding understanding of its characteristics and effective response from HCWs including EMTs. The 2001 anthrax incidents occurred in five states including New Jersey and caused five deaths and 17 injuries (Barras & Greub, 2014; Hayman, 2010).

Anthrax can naturally occur or be humanly inspired such as the 2001 attacks from a biological laboratory (Adalja, 2012; Bush & Perez, 2012; Méthot, 2015; Schweitzer, 2016). Clinical cases of anthrax incidents or attacks can be cutaneous, inhalational, or gastrointestinal (Weant, Bailey, Fleishaker, & Justice, 2014). Besides the 2001 incidents, in 2011, a third inhalational anthrax incident was reported to a Minnesota community laboratory, and the Minnesota Department of Health Public Health Laboratory (Sprenkle

et al., 2014). The first inhalational anthrax incidents occurred in 1976 (Marston et al., 2011; Sprenkle et al., 2014). However, the 2011 incident appeared to have occurred naturally rather than a bio-attack, unlike the 2001 cutaneous anthrax incidents (Sprenkle et al., 2014). Minnesota Department of Health Public Health Laboratory investigated the incident by isolating the Bacillus species from the patient's blood cultures, and the result showed the presence of Bacillus anthracis (anthrax) in the blood specimen (Sprenkle et al., 2014). The patient contracted the incident while traveling through the States of North Dakota, South Dakota, Wyoming, and Montana, and further investigation by the CDC revealed no further exposure to other humans (Griffith et al., 2014). The CDC finding was an indication that anthrax can naturally occur or can be human inspired and identifying the sources of incidents involving bioagents (zoonotic or enzootic) is also a challenge to HCWs (Griffith et al., 2014).

The CDC identified zoonotic diseases as the infectious diseases caused by viruses and bacteria and are usually passed between humans and animals (CDC, 2016c). The CDC further informed that six out of ten cases of infectious diseases in humans come from animals, and three out of every four new cases are from animals to humans. Similarly, Leach and Scoones (2013) conducted a qualitative case study of two zoonotic diseases (H1N1 and Ebola) and noted that 60% of the emerging HIDs (zoonotic) that affect humans originated from animals. The humans once infected become vectors or carriers of the disease. Leach and Scoones (2013) agreed with Grundmann (2014) that the challenges among healthcare professionals are in understanding the nature of the pathogen and how to respond to them to avoid further risks to the population. Leach and

Scoones (2013) used the heuristic approach of modeling in exploring the two cases: H1N1 and Ebola. These modelings were mathematical and process-based models that use data to demonstrate HIDs' epidemiological and ecological relationships; pattern-based models drew inferences of these relations from empirical data, and participatory modeling combined anthropological, ethnographic and participatory approaches. Leach and Scoones (2013) study is important because it established an empirical connection of how the environment plays critical roles in infectious diseases outbreak. During outbreaks choosing a model may pose a challenge because of the urgent need to response and the political pressure. However, Leach and Scoones (2013) recommended a multi-modeling approach to understanding the complex and dynamic realities of zoonotic diseases which included Ebola and Ebola-pox.

The 2001 anthrax attacks revealed a couple of things that were evident over the years, and the deficiencies also manifested during the Ebola epidemic: Deficiencies in government responses and inadequate preparedness and training for possible bioterrorism (Khan, 2011; Taylor, 2015). These deficiencies led to the 2006 Pandemic and All-Hazards Preparedness Act (PAHPA). PAHPA was created to develop national pandemics, disasters, and terrorism response and preparedness plans by the Department of Health and Human Services (DHHS). The result of the PAHPA initiative was The National Health Security Strategy of the United States of America (NHSS). The significance of the NHSS is measured through its main objectives of building community resilience and strengthening and sustaining health and emergency responses practices (Shelton et al., 2012). To address some of the deficiencies, Khan (2011) suggested

bioterrorism preparedness in the future that includes the improvement of coordination between the public health system and EMS and the private sector, and preparedness programs that are verifiable. How has the public health program been able to enhance bioterrorism preparedness among EMTs for cutaneous form of disease such as Ebola?

Smallpox

Smallpox, another deadly and highly cutaneous virus has the potential for use as a biological weapon (Anderson & Bokor, 2012; Weant et al., 2014). Viruses also cause smallpox as is the case with Ebola. The virus in an infected person exhibits the following symptoms: high fevers, abdominal pain, vomiting, headaches, prostration, and myalgia after which rashes begin to appear (Chopra et al., 2014; Petersen et al., 2015). Transmitted from humans into the population, smallpox infection has a fatality rate of 30 percent; has 12 – 14 days of the incubation period and is a major source of bioagent especially the variola major form that is more lethal than the variola minor. (Weant et al., 2014). Weant et al. (2014) conducted a study that focused on smallpox, viral hemorrhagic fevers, and botulism toxin as potential bioagents with high fatalities rates. Smallpox like Ebola is transmitted from person to person and as such posed threats to EMTs and the general population. Weant et al. informed that emergency workers need to be aware of these threats, and have adequate knowledge of all Category A agents, emergency protocols and practices to mitigate secondary infections.

Ebola

Ebola was first identified in 1976 in Sudan with a high mortality rate of 50 percent (Taylor, 2015). Although there have been about 29 outbreaks of the epidemic, the

2014 outbreaks were more devastating and resulted in about 28,183 cases and 11,306 deaths by September 2015 and huge economic losses (Maras & Miranda, 2016; Coltart, Johnson, & Whitty, 2015; WHO Ebola Response Team, 2014). As deadly as the virus is, Ebola is rendered ineffective if certain measures are taken. Ebola is rendered ineffective at a boiling point of 5 minutes or heating level of 60°C for 30 to 60 minutes but can be a portent for a human to human transmittal in room temperature for many days (Taylor, 2015). The symptoms of Ebola include a severe headache, high fever, general body weaknesses, muscle, stomach and joint pains, sore throat, and lack of appetite. The ability of Ebola surviving for days is what makes the disease dangerous, and potential biological agent.

The 2014 EVD created global concerns and apprehension that terrorist groups may capitalize on the human to human transmission to weaponize the virus (Teckman, 2013; Gire et al., 2014). The concern was that terrorist groups might acquire the virus and turn it into a biological agent. As a Category A pathogen, Ebola has the attributes and capabilities of posing a high risk to national health security because of the ease of transmitting the virus from person to person, causing social and economic disruption, high mortality, and requiring special preparedness actions from public healthcare system (Maras & Miranda, 2016).

Although the EVD epidemic has ended, the immediate concern was examining and understanding the bioterrorism preparedness for EVD and other potential pathogens vis-a-vis risk mitigation, rapid response initiatives, adequate facilities, equipment, and trained HCWs (Kabir et al., 2016; Maras & Miranda, 2016). Global efforts that appeared

to have prevented the virus from causing more deaths included the CDC initiatives of collaborating with the World Health Organization (WHO) and sending about 1200 healthcare workers to the West African region (Frieden & Damon, 2015). Also, updated Ebola management protocols were developed and used during the epidemic (Caro et al., 2015). Although the spread of the virus has been controlled, little study has investigated the extent to which terrorist groups may have shown interest in acquiring the virus for terrorism purposes. Also, little research has been conducted on the post-Ebola bioterrorism preparedness and response strategies among HCWs and EMTs. Maras and Miranda (2016), noted the attempt by a group, Shoko Asahara, in the 1990s that went to the Democratic Republic of Congo (former Zaire) to inquire about Ebola and possibly procure a sample. Furthermore, there is no conclusive evidence that terrorists did or did not acquire and preserve the virus for development and, future bio-attacks given their previous attempts at acquiring it. What countries, public healthcare officials, and HCWs can do is to harden themselves through training, and education of HCWs, creating institutional support and adequate response strategies and developing vaccine and therapeutics (Choi, Hong, Hong, & Lee, 2015; Smith & Hewison, 2012).

Additionally, a study by Kar, Pradhan, and Pattnaik (2012) pointed to an emerging disease - Ebola pox (or black pox, a combination of Ebola and smallpox) as a possible biological weapon. Kar et al. (2012) overview of Indian bioterrorism preparedness was significant because it revealed the need to prepare for known HIDs and emerging HIDs that are also resistant to the changes in the environment including

humidity, cold and heat. The Ebola pox that manifested in Pakistan killed ten people, and thus demonstrated its lethality as a potential new HID (Kar et al., 2012).

The study conducted by Taylor (2015) focused on the preparedness policies and practices following the 2014 Ebola incidents in the United States. In noting the high Ebola fatality rate of 90%, the study highlighted the factors that can help minimize the fatality rate of Ebola. These factors included the state of the existing healthcare, the general health of the population, the nutritional health of the population, the affected patients' immunology, and the response capabilities of the healthcare system (Taylor, 2015). The study is significant to my study in the assessment of the capabilities of the healthcare system especially EMTs' capabilities to respond to bioterrorism incidents. Taylor (2015) specifically noted the varied and incoherent responses to the Ebola incidents including the appointment of a non-medical and non-immunologist that handled the epidemic in the United States. The study highlighted the possible weaponization of the pathogen by terrorists and infect unsuspecting victims who are the focus of this study. If terrorists become Ebola vectors, how prepared are EMTs to handle the situation and transport patients to AHFs (and between hospitals) without risking themselves, and the wider community? Taylor (2015), like a previous study (Abraham et al.,) on the anthrax incidents noted the missed opportunities to use the Ebola epidemic as a 'test run' in assessing the U.S. preparedness for bioterrorism.

The need to harden HCWs including EMTs against weaponized EVD and other cutaneous diseases in the United States is because the U.S. cities appear high targets for terrorism (including homegrown terrorism), often because of language diversity,

residential instability and urbanization (Brooks, 2011; LaFree & Bersani, 2014). Bioterrorism hardening is also critical because of the many incidents of Ebola in the East African region that is politically unstable and conducive for terrorism, and globalization (Teckman, 2013). Many terrorist groups operate in the East African region (Maras & Miranda, 2016; Teckman, 2013). There is, therefore, the concern that infected persons may be used as human weapons or human vectors to infect unsuspecting population in crowded areas such as the airport as terrorists have done and continue to do with body explosives for terrorist attacks (Taylor, 2015; Teckman, 2013).

Importance of Bioterrorism Preparedness

Disaster preparedness is critical to mitigating the impact of disasters, minimizing threats, and reducing vulnerabilities and risk to HCWs and the population when faced with hazardous situations (Pandey, 2019; Spain, Clements, DeRanieri, & Holt, 2012). September 11, 2001, terrorism brought about the Homeland Security Presidential Directive (HSPD-5) which in 2004 initiated the National Response Plan and the National Incident Management System (Barakey, 2013). The National Incident Management System outlined the need for collaboration and cooperation among all levels of government to prepare, prevent and respond to bioterrorism and public health emergencies (Barakey, 2013; Nemane, 2012; Spain et al., 2012). Examples of federal agencies and state governments collaboration in disaster response included Hurricane Katrina (New Orleans) and Hurricane Sandy (New Jersey) with clear failures and lessons learned for future emergency preparedness response (Dittmar, 2013; Powell, Hanfling, & Gostin, 2012). The failures of the responses to the Hurricane Katrina led to the change in

the implementation of the National Response Plan to include the community and later renamed National Response Framework (Department of Homeland Security (DHS), 2016). The 2002 Bioterrorism Act through the National Response Framework initiated incident management strategies that included the all levels of government, the private sectors, and the non-government organizations (NGOs), and the community for incidents and emergency preparedness and response (DHS, 2016; Nemane, 2012). The legislation and policies were indications of the importance the federal government attached to disaster preparedness and responses.

In many states, such as New Jersey, of the about 465 private and public emergency operators, most are privately run EMSOs (New Jersey Department of Health, 2017). Furthermore, disasters and the response to disasters require some level of resources: human, material and financial depending on the nature of the disaster as the United States government did over the years (Monroe, 2014; United States Congress, 2004). The functions of many HCWs and EMTs are closely related and equipping them with adequate and effective training is critical to disaster mitigation and preparedness (Williams, Nocera & Casteel, 2008; Passi et al., 2015).

A quantitative study conducted by Williams et al. (2008) found that the effectiveness of disaster response training for out-of-hospital HCWs was mixed and called for future studies that are more rigorous. However, other studies concluded that training of healthcare providers and increased disaster management knowledge and skills especially emergency responders increased their willingness to respond, and attitudinal and behavioral intention rates (Arbon et al. 2013; Clancy, 2008; Kar, Pradhan, &

Pattnaik, 2012; Rokach et al., 2010). The study conducted by Rokach et al. (2010) focused on Physicians and nurses' willingness to respond to bioterrorism attacks. The study found that physicians and nurses' knowledge of the anthrax disease had a positive relationship with their willingness to respond to anthrax attacks. The study, unlike my study, was not on contagious disease such as Ebola. The study (Rokach et al., 2010) admitted the limitation of non-applicability on contagious disease and recommended future studies.

In 1999, the CDC initiated a Public Health Preparedness and Response for Bioterrorism program (Duncan, Ginter, Rucks, Wingate, & McCormick, 2007). The program funded local and public health preparedness and responses for bioterrorism, infectious diseases and other emergencies responses (Duncan et al., 2007). In 2004, after five years of the program, the CDC reviewed the program's effectiveness in bioterrorism and disaster management and response and requested further funding (Duncan et al., 2007). The review also led to the development of strategic areas for disaster preparedness: prevention, detection and reporting, investigation, control, recovery and improvement (Duncan et al., 2007). The CDC's five areas of preparedness mirror those of the World Health Organization (WHO): surveillance, healthcare response, public health intervention, communication, and command (Craig, Kasai, Li, Otsu, & Khut, 2010). The attention of the WHO to bioterrorism demonstrates the worldwide apprehension of weaponized bioagents and the need to have response strategies. The apprehension is heightened by the expected increase for ambulatory healthcare in the case of large-scale infectious disease depending on the nature of the disease (Craig et al.,

2010). Craig et al. (2010) observed that early and adequate response by healthcare workers would not only save lives but prevent a community-wide spread of the disease. The review of the literature on bioterrorism preparedness demonstrated that although training, education, and uniformity in emergency response practices are critical for effective bioterrorism response and practices, they are rarities among EMTs.

EMTs' Training, Readiness, and Hardening

The question of how EMTs prepare for biological attacks is of great importance to mitigating HCWs' risk, and critical for community-wide bioterrorism response and disaster mitigation. The answer can be found in EMTs' understanding and identification of the factors that are critical to bioterrorism hardenings such as knowledge of emergency response protocols, and knowledge of characteristics of different potential bioagents (Eddy & Sase, 2015). Response strategies will require emergency responders' knowledge of what to do to adequately confront bioterrorism situations. Such knowledge will involve knowledge of existing preparedness and response protocols acquired through training and regular exercise (Edwards, Price, Gordon, & Gadgil, 2005; Crane, 2010; Abrol, 2016).

In a 2010 study, Olson, Scheller, Larson, Lindeke, and Edwardson, (2010) demonstrated that bioterrorism and emergency readiness (BT/ER) training increased emergency response performance. In a follow-up study Olson, Scheller, and Wey, (2014), did a stimulated quantitative survey of 17993 (out of 20151 potential participants) to determine the relationship between the duration of BT/ER training to bioterrorism response performance. The research found that those with forty-five or more hours

training performed better compared to those with less than forty-five hours of training. The study was important because it established the need to not only train HCWs and EMTs on bioterrorism but to note the duration of the BT/ER training especially after the 2014 Ebola epidemic and to examine their knowledge of bioagents.

The study conducted by Abrol (2016) was significant to my study because of its finding that an estimated 17 countries have active bioweapons programs and are also sponsors of terrorism. The study used India which experienced H1N1 influenza epidemic in 2015 as a case study. Lessons learned from the study on India bioterrorism preparedness could be utilized by other countries including the United States. As Abrol (2016) noted, the effects of biological attacks depended on the preparedness strategies in place to mitigate the attacks. The study recommended training and development of communication infrastructure for first responders at the community level for effectively combating bioterrorism attacks. Abrol (2016) also suggested integrated international cooperation for sharing knowledge, information exchange, and possible bioterrorists extraditions.

However, Malet and Korbitz (2015) informed that emergency responders have often not adhered to the regulations and best practices recommended by regulatory agencies such as the CDC or the Homeland Security Department (DHS). The study also noted the inadequate knowledge of agents, symptoms of biological agents, and sources of contaminations despite exercises among public health officials including public emergency responders. Malet and Korbitz (2015) further observed that information received by public health officials are not always shared with other emergency

responders that operate outside the domain of public health daily regulation. The study recommended changing this attitude for effective bioterrorism preparedness. The findings and suggestions are particularly important because EMTs' bioterrorism preparedness should align with the DHS and CDC-recommended protocols and best practices.

EMTs knowledge of PPE

The 2014 incidents of EVD in the United States elicited varied responses from some of the states where the virus manifested: New Jersey, Texas, and Georgia. Olliaro, Horby, and Torreele (2015) questioned why the United States lacked adequate health tools for protecting against EVD and other emerging infectious diseases. However, the study focused on developing an affordable and efficient reach to diagnostics, medicines, and vaccines for biological agents that would enhance collective public health security rather than on HCWs preparedness for bioterrorism response (Olliaro et al., 2015). This study was significant because evaluating HCWs emergency healthcare preparedness helps address the question of secondary infection through the first responders and HCWs especially EMTs.

Critical aspects of bioterrorism preparedness are the identification of factors that would help avoid secondary infection through HCWs. The Pandemic and all-Hazards Preparedness Reauthorization Act (PAHPRA) of 2013 was enacted to address the issue of secondary infection through HCWs (Eddy & Sase, 2015). PAHPRA also mandated hospitals to continually review the workplace hazards and to minimize risks through a hazard vulnerability analysis assessment process (Eddy & Sase, 2015). The objective of the PAHPRA was to improve hospitals emergency preparedness practices and their

capabilities to meet challenges posed by infectious diseases such as Ebola. For the hospital workers, vulnerability analysis assessment is a required process for bioterrorism hardening against infectious diseases. Also important is the knowledge of PPE, the ability to accurately diagnosis infectious diseases, and knowledge of the zoonotic nature and sources of the disease (Eddy & Sase, 2015). However, Decker, Sevransky, Barrett, Davey, and Chertow (2014) noted the challenge of caring for Ebola patients while donning the PPE because they are likely to affect job performance. Hence, the need for EMTs to have a clear understanding of how to don PPE and work with them. But Decker et al. (2014) informed that with carefully planned protocols and training, patients could receive needed care without the secondary infection of HCWs and EMTs.

Eddy and Sase (2015), further noted that bioterrorism preparedness policies and programs should protect hospitals against all viral hemorrhagic fever (VHFs) such as Ebola. However, the study found that hospitals did not adhere to preparedness programs by performing the vulnerability analysis assessment. The finding by Eddy and Sase (2015) supports the need to examine the current protocols in the operations of other healthcare population outside of the hospital environment, such as the EMTs. If the protocols exist, how knowledgeable are EMTs of the processes and how have the protocols helped in their emergency response and practices?

Threat Assessment

The threats of biological attacks are evident in the proliferation of terrorist groups, state-sponsored terrorist activities including their active bioagent programs, and increased use of biological agents (Abrol, 2016; Grundmann, 2014; Kadlec, 2013). This qualitative

case study focused on the threats, vulnerabilities, and existing capabilities to withstand the threats if they occur. Major emergency response capability strategies are the willingness of EMTs to respond to terrorist and biological attacks and their knowledge of response strategies acquired through training (Clancy, 2008; Rokach et al., 2010; Taylor 2015).

Tambunan, Parikesit, and Saputro (2014) informed that there are two critical issues in a biological threat assessment: the expected impact of the attack on the target (create fear and disrupt socio-economic activities), and the potentials of the attacks occurring and being successful. Both criteria depended on the capabilities of the attackers, and values and vulnerabilities of the targets respectively (Tambunan et al., 2014). Historically, past biological incidents and military activities met these criteria. The past incidents and military activities included Japan's Unit 731 during the World Wars 1 and 2, Rajneeshee Religious Cult incident of 1984, Aum Shinrikyo Cult in 1995, 2001 letters with Anthrax, Middle East Respiratory Syndrome (MERS) in Saudi Arabia in 2012 (Tambunan et al., 2014).

The issue of bioterrorism continues to pose a global concern. The concerns were borne out of the progress in the development of life science and the intention of terrorists to exploit infectious diseases for biological attacks (Maras & Miranda, 2016; Suk et al., 2011). Suk et al. (2011) categorized research on viruses or infectious diseases into dual uses (dual-use research of concern – DURC): Positive and negative uses. Maras and Miranda (2016) observed that terrorists could turn themselves into "human Ebola munition." However, the focus of the U.S. National Science Advisory Board for

Biosecurity (NSAABB), is on the simultaneous uses of research on infectious diseases. Infectious diseases have potentials to help increase knowledge as well as for misuse by other groups such as terrorists. Although Suk et al. (2011) found that the biological agents that require high technologies are less likely to be deployed, it noted the importance of preparing for their eventual use for biological attacks. So, while there is the need for freedom of research on infectious diseases, there was also the threat or question of the research process been deployed for terrorism as the 2001 anthrax attacks showed (MacIntyre, 2015).

The United States government understood the threats of not only terrorist attacks but also of potential bioterrorist attacks. Consequently, it allocated a huge amount of fund into the bioterrorism programs (Monroe, 2014). Following the 2001 anthrax incidents, the United States government in the 2002 and 2003 fiscal years provided a total of $2.5 billion towards the initiatives to get local, state, federal governments, hospitals, and EMSOs prepared for bioterrorism (United States House of Representatives Committee on Science Report, 2004). Furthermore, in 2004 the U.S. HR Committee on Science conducted a hearing to discuss the threats posed by bioterrorism, the vulnerabilities, and the preparedness of the various levels of governments and emergency medical services providers (United States House of Representatives Committee on Science Report, 2004). The result of the 2004 Congressional Hearing was the Project Bioshield Act of 2004 (Monroe, 2014; Gottron, 2014). Other events related to biological incidents in addition to the 2001 U.S. anthrax attacks prompted the Committee meeting. The other events included the severe acute respiratory syndrome in China and globally in 2003.

Before the 2001 bioterrorism-related attacks, inhalational anthrax occurred in the United States in 1976 (Jernigan et al., 2001). Anthrax has been used by countries since the early 20th Century during and after the First and Second World Wars by countries including Japan, United States, United Kingdom, and Russia (Schmid & Kaufmann, 2001). So, the technological knowledge is there, and terrorist groups are believed to be developing biological agents for the purposes of deploying them for terrorist activities (Abrol, 2016; Maras & Miranda, 2016).

The 2001 anthrax incidents affected 22 people (five deaths and 17 sicknesses) who tested positive to Bacillus anthracis powder (Schweitzer, 2016; Thompson, 2016). The fatality of the anthrax attacks demonstrated the nature and range of anthrax as a potential covert bioterrorism agent. Other bioagents including smallpox and Ebola have similarly devastating effects as the thousands of deaths following the 2014 Ebola epidemic illustrated (Maras & Miranda, 2016). The pathogens often spread through physical contacts, cause not only high fatality but also cause panic in the population and economic dislocation in the society (Anderson & Boker, 2012; Barrow et al., 2015; Gunaratne, 2015; Pinto, 2013; Zhang et al., 2014).

Smallpox, although eliminated since the 1980s, the virus is still stockpiled in many laboratories for scientific purposes in the United States and Russia, and additional concerns of more stockpiles in sophisticated laboratories elsewhere, insider threats and easy access to information online (Henderson, 2014).Given these concerns, there is no guarantee that smallpox, SARS coronavirus and transmissible influenza virus AH5N1 currently under study in laboratories cannot be released by someone or group of persons

with access to them for biological attacks (Lipsitch & Bloom, 2012). The 2001 anthrax attacks in the United States are examples of an intentional release of a biological weapon for terrorist purposes from a laboratory. The public concerns over potential bioterrorist attacks are not far-fetched given the growth of home-grown terrorists and lone wolf terrorists inspired by foreign terrorist groups such as al-Qaeda and the Islamic State (Navarro & Villaverde, 2014; Ramakrishna, 2014). Previous studies (Weant et al. 2014) have noted that the challenges of bioterrorism preparedness for HCWs include recognizing covert biological agents, learning and adapting to preparedness plans, response, and practices.

Ebola and the new emerging hybrid – Ebola pox are among the deadliest cutaneous infectious diseases (Kar et al., 2012; Khan, 2011; Taylor, 2015). Ebola, one of the deadliest forms of the Viral hemorrhagic fevers is caused by ribonucleic acid (RNA) viruses namely, Arenaviridae, Bunyaviridae, Flaviviridae, Filoviridae, and Rhabdoviridae; with a fatality rate of between 50% to 90% (Passi et al. 2015). Of the five species of Ebola, the Zaire Ebola virus has the highest fatality rate of 90%; tends to reoccur and fall into the Category A as the CDC and the WHO classified the pathogens (Passi et al. 2015).

Vulnerability Assessment

Terrorists are likely to deploy biological weapons because they are cheap and easy to procure; ease to disseminate; have the potential to cause panic, maximize fatality in the population, and dislocate the targets' economy (Cenciarelli et al. 2013). The United States is a potential target for terrorist attacks, whether chemical, biological, radiological,

nuclear or explosives (CBRNE) at sources of water supply and pharmaceuticals distribution (Cinturati, 2014). The U.S. vulnerability was also demonstrated in the weaknesses identified in the handling of the Ebola outbreak in 2014 (Olliaro, Horby, & Torreele, 2015). Also, HCWs are most vulnerable to a secondary infection of HIDs due to lack of or non-adherence to protocols and inadequate protective equipment (Maras & Miranda, 2016).

The United States is also a good target for bioterrorism because of the many infrastructures and other targets that have the potential to cause substantial huge economic cost and human losses, and iconic targets such as the Statue of Liberty and Pentagon (Gruenewald, Allison-Gruenewald, & Klein, 2015). The 2001 terrorist attacks resulted in a significant loss of lives and destroyed the aura of invincibility or security in the United States (Toomey & Singleton, 2014). Gruenewald et al. (2015) in a study discussed how Clarke and Newman (2006) applied eight basic principles namely, exposed, vital, iconic, legitimate, destructible, occupied, near, and easy" (acronym: E.V.I.L D.O.N. E) to assess the vulnerability and attractiveness of targets to terrorist attacks. The United States has many targets that meet these targets using the theory of situational crime prevention (SCP) as Clarke and Newman (2006) applied them (Gruenewald et al., 2015). Though, a quantitative study on eco-terrorism, the study was significant to my study because it demonstrated how terrorists are most likely to identify targets using the principles of E.V.I.L D.O.N. E, and SCP. The eight principles were useful to my study in helping identify possible vulnerable targets such as areas with a

high concentration of human beings for maximum casualties, and ease targets to avoid detection.

Similarly, Becker (2014) analyzed 84 lone wolf terrorist attacks on the civilian, government, and the military targets and found that 61 percent of such cases were targeted at the civilians because of the inadequate hardening of the civilian targets. Civilian or soft targets such as transit stations, bus terminals, and shopping malls were also targeted because of their potentials for causing maximum casualties and inflicting fear in the population (Morris, 2015). In the article on maritime security in the wake of the 9/11 terrorist attacks, Johnson (2013) pointed to the vulnerability of the United States because of globalization and its perception by terrorists as a wealthy country with potential for enormous economic losses if attacked. Johnson (2013) further noted in the survey study of security at the ports, the relationship between international free trade and maritime terrorism and noted the vulnerability of the United States because only five percent of over 500 million cargos are inspected at the United States ports yearly.

The 2001 terrorist attacks on the World Trade Center and the Pentagon exemplified the vulnerabilities the United States face and the goals of the terrorists to cause maximum fatalities and create fear (Gruenewald & Allison-Gruenewald, 2015; Johnson, 2013; White, Porter, & Mazerolle, 2013). In 2014, Ebola reached the United States soil, and the manner the epidemic was handled by the various authorities raised concerns of unpreparedness among the HCWs and governments (Ganguli et al., 2016; Harris, Dadwal, Wu, & Syed, 2015). For instance, Ganguli et al. (2016) discovered in their cross-sectional web-based study of 202 respondents out of 462 targeted participants

that 75% of the cases referred to CDC were wrongly referenced. Similarly, the varied responses from the various governments to the epidemic revealed the unpreparedness of HCWs, acute healthcare facilities, including the lack of uniformity heightened the vulnerabilities of the United States to bioterrorist attacks (Rickles & Catarious, 2015). The inadequate responses occurred despite the Bio-watch Program developed to improve the capability of responding agencies to interpret data collected for necessary actions (Koenig, 2013). The study further pointed out that bioterrorism preparedness should involve an effective surveillance system that can interpret and put into action the outcome of the interpretation. The capability of data interpretation is critical for HCWs readiness for bioterrorism response and capability to detect and analyze bioagents while responding to disasters (Department of Homeland Security, 2014).

Bioterrorism Preparedness in New Jersey and the County.

Bioterrorism is the emerging public health threat locally, nationally and globally (CDC, 2000; Maras and Miranda, 2016). Predicting next terrorist or bioterrorist attacks are hard to decipher, although (Bakker, 2012; Navarro & Villaverde, 2014) documented that terrorism will continue to exist, the modus operandi may change. Hence, the possibility of bioterrorist attacks remains a concern to HCWs (Olsen, 2013). To allay these concerns, HCWs should be prepared for biological attacks because they are more vulnerable than the population as their emergency response roles require them to attend to infected persons (Walker & Whitty, 2015). The Ebola epidemic and the responses to the epidemic provided an opportunity to reassess the bioterrorism preparedness of the HCWs because as the epidemic demonstrated, HCWs are at a higher risk of infection

(Maras & Miranda, 2016) The 2001 anthrax attacks were followed by major bioterrorism preparedness programs, legislation and increased bioterrorism preparedness funding (Nemane, 2012). The bioterrorism preparedness programs and funding benefited local public health authorities in the areas of public health awareness, the collaboration between the levels of government, public health infrastructure improvements, and improved disaster response readiness and assessment (Staiti, Katz, & Hoadley, 2003). Incidentally, both anthrax and Ebola incidents affected New Jersey.

The 2001 terrorist and anthrax attacks revealed flaws in our emergency response, and to correct the flaws the Bush Administration in 2002 released $1.1 billion to states, territories, and some cities for the development of bioterrorism preparedness plans (Markowitz & Rosner, 2004). The cities mentioned were Chicago, New York, and Los Angeles. Interestingly, Newark, the largest city in New Jersey with proximity and shared critical infrastructures with New York was not mentioned. Also, the City of Camden that was actively involved in the 2001 anthrax attacks was equally not part of the fund recipients. The fund was also designated to support and enhance bioterrorism preparedness readiness against infectious diseases and to create regional acute healthcare facilities capable of responding to bioterrorism attacks.

In New Jersey, the New Jersey Office of Emergency Management coordinates emergency preparedness and response including natural and human-made such as the intentional acts of terrorism or bioterrorism in collaboration with the federal, state and local partners (NJOEM, n.d). In the counties, there are also regional emergency management offices. For instance, in the selected county, the County Regional Health

Commission (ERHC) is the point agency with the Department of Human and Health Services (DHHS) and New Jersey Department of Environment Protection (NJDEP). The role of the county regional health commission was to coordinate the county emergency preparedness initiatives. However, the operational implementation of emergency responses is handled by the County Office of Emergency Management located in the County Sherriff's office. A review of the county emergency mission statement showed that preparedness, mitigation, response, and recovery were part of the strategy to harden HCWs and emergency responders. The goal of the county EOM is to prevent the occurrence of natural and human-made disasters and reduce the impact of any such disaster.

In 2015, sequel to the 2008 Plan, the county OEM updated its all-Hazard Mitigation Plan (HMP) and reaffirmed its mission statement. The mission statement reaffirmed the need for strategic planning, partnership, collaboration to help identify and mitigate the vulnerability of HCWs and the community to hazards caused by humans or nature in the county.. Bioterrorism preparedness is part of the HMP, but the mission statement lacked a clear policy statement towards bioterrorism readiness and response.

Incidentally, Newark, the largest city in New Jersey is not part of the Commission (ERHC). Also, there is also the New Jersey Medical Reserve Corps (MRCs) who assist during emergencies. MRCs are volunteers who assist during medical and non-medical emergencies, and natural and non-natural disasters including bioterrorism, pandemic flu, floods, and blizzards (New Jersey Medical Reserve Corps. (NJMRC),

2004). MRCs work under the county and local health systems as part of emergency and disaster preparedness programs (NJMRC, 2004).

The study by Abatemarto et al. (2007) informed that the anthrax attacks showed a lack of preparedness for biological attacks especially the knowledge of PPE for respiratory protection in New Jersey. The study focused on providing training and education on the use and importance of N-100 respiratory-protective face masks against biological and chemical attacks. The study was timely given that anthrax and terrorist attacks just occurred a few years earlier, and there were few studies that analyzed the first responders' bioterrorism preparedness. The study recommended future studies on the state of preparedness of first responders for bioterrorism and knowledge of infectious diseases. My study built upon the study by Abatemarto et al. (2007), by examining and understanding what has changed since then. My study furthered the knowledge by examining the infectious disease and bioterrorism preparedness following the 2014 Ebola epidemics in the United States and used EMTs in New Jersey for the study.

The New Jersey Department of Health, Office of Emergency Medical Services (NJDH-OEMS) certifies EMTs and conducts training needs and continuous education in New Jersey (New Jersey Office of Emergency Management Services, 2017). The first responders that OEMS train included EMT-basic and EMT-paramedics. OEMS also licenses the following: ambulances mobile intensive units, mobility assistance vehicles and specialty care transport units both hospital-based and non-hospital based (New Jersey Office of Emergency Management Services, 2016). Created in 1967, OEMS has over 27,000 EMT-Bs and EMT-Ps and over 4500 emergency vehicles (NJOEMS, 2016).

Summary and Conclusions

This chapter highlighted the problems and challenges HCWs, especially EMTs faced in disaster situations and exposed the lapses in bioterrorism preparedness plans since the 2001 anthrax attacks. The literature review also revealed the missed opportunity of using the 2014 Ebola epidemic as a tabletop scenario to gauge the bioterrorism preparedness programs in place (Taylor, 2015). This missed opportunity was despite the challenge of biological threats to health security in the United States (Shelton et al. 2012). The chapter began with a presentation of the literature search strategy and the theoretical framework for the study: MST. The review of the literature showed the prevalence of inadequacy of bioterrorism preparedness practices, increased threats, heightened vulnerability of HCWs, the vulnerability of soft targets, and, that the willingness to respond to all-hazard emergencies was tied to increased knowledge of bioagents. Other studies found that the lack of preparedness increased the risk of secondary infection and identified the need for regular training.

Bioterrorism is of both national and global concerns and threats because of the minimal cost involvements and the challenges it poses (Abrol, 2016; Cenciarelli et al. 2013; Wiwanitkit, 2014). Therefore, preparing national, states and local healthcare agencies, and HCWs for possible bioterrorism threats is very important. Preparedness and early detection require increased biological and chemical terrorism awareness among front-line health-care providers because they are in the best position to report suspicious illnesses and injuries (CDC, 2000). Most research on HCWs' bioterrorism preparedness had focused on hospital nurses' and other first responders' preparedness, leaving critical

gaps in understanding the EMTs' pre-hospital bioterrorism readiness and knowledge of bioagents which are emerging health and terrorism threats. Furthermore, although, there are extensive policies and studies on managing patients with infectious diseases (Aghaei & Nesami, 2013; Smith & Hewison, 2012; Whetzel, Walker-Cillo, Chan, & Trivett, 2013), there is little research on specialized transportation of patients with HIDs such as Ebola to avoid secondary infection, and on EMTs' understanding of emergency response protocols and in handling HIDs.

In this chapter, the study identified the need for future studies in the areas of EMTs preparedness for cutaneous diseases such as Ebola, smallpox and Ebola pox. Before the 2014 Ebola incidents, there was little literature on cutaneous forms of bioagents as weapons for terrorism. The Ebola epidemic and the lack of response uniformity demonstrated the need to study EMTs and indeed, HCWs' bioterrorism preparedness and practices.

Also, as the review of the literature showed, much of the literature that existed were on bioterrorism preparedness in the pre-Ebola era and after the anthrax attacks of 2001. Little literature had focused on the possibility of weaponization of pathogens such as smallpox and EVD, and the emerging disease: Ebola pox. A study by Kar et al. (2012) pointed to this emerging disease - Ebola pox (black pox) as a new biological weapon. Kar et al. (2012) noted that the disease, a combination of Ebola and smallpox is considered more lethal than Ebola and is resistant to the changes in the environment including humidity, cold and heat. This study addressed the gap in EMTs' post-Ebola bioterrorism preparedness, response protocols, and practices. The study also filled the gap in the

literature by examining the problems and challenges confronting EMTs and identified the factors for bioterrorism hardening and policy formulation using the theoretical framework of MST. The study's findings would increase knowledge by facilitating an increased understanding of the growing field of bioterrorism preparedness and hardening.

In Chapter 3, the qualitative case study design helped fill the gap in the literature by examining the current bioterrorism preparedness among EMTs. The research study involved the processes of selecting the 18 EMTs who have theoretical and practical experiences and understanding of emergency medical response practices before and after the 2014 Ebola epidemic. The interview format was significant in examining and understanding factors EMTs perceived as relevant to bioterrorism hardening.

Chapter 3: Research Design

This qualitative case study was intended to examine and understand how knowledgeable and prepared EMTs in New Jersey were for cutaneous forms of biological agents, and the policy and political implications of a lack of knowledge or inadequate knowledge of and preparedness for bioagents. EMTs were the focus of this study, and the study was conducted a few years after the Ebola epidemic that exposed HCWs unpreparedness for bioterrorism and bioterrorism policy lapses. This study was embarked upon to understand the bioterrorism, and emergency response (BT/ER) preparedness of EMTs. This study is important because terrorist groups are exploring and developing bioactive programs (Abrol, 2016; Kadlec, 2013). Some studies demonstrated that training, education, and uniformity in bioterrorism responses and protocols were important for emergency workers' readiness for biological attacks (Khan, 2011; Waldrop et al., 2014).

The problem of unpreparedness for biological agents or lack of knowledge of bioagents' characteristics was worth examining because such unpreparedness not only puts emergency workers at greater risk but also has community-wide health implications (Passi et al., 2015). This study, therefore, would be beneficial to HCWs, EMTs, first responders, and to local communities' emergency response practices and bioterrorism hardening (BH). The study added to knowledge by highlighting the problems EMTs face during emergency response situations and proffered ways to increase EMTs knowledge of bioagents and how the knowledge could increase community-wide bioterrorism preparedness.

This research method chapter also detailed the rationale for the study, the research design, and, the role I played as the researcher. Particularly, I stated how I avoided potential researcher biases. The method for the data collection section addressed possible replicability, noted the key research protocols and the method of research participants' selection. Other issues this chapter addressed included ethical concerns and the analytical data method that enhanced the study's credibility and trustworthiness.

Research Design and Rationale

Research Tradition

The study provided suggestions for enhanced bioterrorism preparedness as it addressed the research questions: Are EMSOs and EMTs in New Jersey prepared for a cutaneous form of biological attack such as EVD? What are the policy and political implications of lack of preparedness? To answer these research questions, the study used the qualitative research design (QRD) to examine the issue of bioterrorism hardening (BH) among HCWs with a focus on EMTs. BH is the preemptive preparation for protecting HCWs who are deployed to disaster areas; bioterrorism preparedness (BP) includes exercises to mitigate the impact of biological attacks (Kabir et al., 2016; Rickles & Catarious, 2015). The study also examined the knowledge of cutaneous diseases such as Ebola among EMTs, and the emergency response practices if bioagents were weaponized for biological attacks (MacIntyre, 2015). This qualitative case research examined the bioterrorism (BT) preparedness and emergency response practices (ERPs) in New Jersey from the perspective of the county EMTs. Examining and understanding

the BT preparedness and ERPs in New Jersey will educate EMTs on the areas that require improvements and training for enhanced ERPs.

A qualitative case study is ideal for the interview of participants in their natural settings and provides the researcher the opportunity for an in-depth questioning to understand the phenomena: bioterrorism hardening, bioterrorism preparedness, emergency response practices, and Ebola. I chose the approach because it is amenable to multiple sources of data, which enhanced the study's internal validity and reliability. Finally, case study approaches are flexible and are constructed to suit the cases and the research questions (Hyett, Kenny, & Dickson-Swift, 2014). Qualitative research studies ask probing questions for in-depth information to understand the meaning of the central issue(s) from the participants' diverse ideas, experiences, perspective, and the meaning they attach to the problem (Creswell, 2014; Kozleski, 2017). The research questions in qualitative research establish the foci of the interview procedures and the questions are open-ended for the participants to provide detailed information (Creswell, 2014). The research questions for this study focused on the nature of potential biological agents and EMTs' knowledge of bioagents.

QRD was also chosen because of its flexibility, provided a holistic account of the phenomenon. It is also a useful method for collecting, analyzing, and interpreting data from multiple sources to examine and gain an insight of EMTs BT/ER readiness for and willingness to respond to cutaneous bioagents (Fusch, & Ness, 2015). Critical elements in qualitative research are consistency and dependability that bring about validity which led to the studies' credibility and trustworthiness (Venkatesh, Brown, & Bala, 2013). The

elements for assessing the trustworthiness of a QRD case study suggested by Lincoln and Guba (1985) are credibility, dependability, confirmability, and transferability (Houghton, Casey, Shaw, & Murphy, 2013). Credibility means the data mining process is believable; dependability involves trustworthiness of the process and data collected; confirmability can be achieved using qualitative data analysis software such as *in vivo*, and transferability entails the ability of the study being interpreted and transferred to other contexts (Houghton et al., 2013). Unlike a quantitative research design which key elements are the validity and reliability of the measuring tools, in qualitative research, the trustworthiness of the researcher as a critical research tool is most significant (Tavakol & Sandars, 2014).

A qualitative case study was also chosen over other approaches such as quantitative and mixed methods because case studies are constructed to suit the cases and for probing research questions (Hyett et al., 2014). The qualitative design uses fewer participants; gives an interpretation to the issue and uses an inductive approach to explore and attach meaning without predetermined typology, while quantitative approaches use larger sample population and provide formal or predetermined attributes for the study (Brown, Strickland-Munro, Kobryn, & Moore, 2017).

Among the qualitative research approaches, I chose the case study approach. The qualitative case study approach explores a single case in-depth based on context-dependent facts and holistically and it aligns with the study's goal of examining in-depth EMTs' bioterrorism preparedness and emergency response readiness (Collins & Cooper, 2014). On the other hand, the other approaches deal with the study of individuals

(narrative), explores the meaning of experiences towards a phenomenon (phenomenology), generates a theory (Grounded theory) and describes and interprets a culture-sharing group under study (Creswell, 2013). These other qualitative research approaches were not suitable for my study because none of the other methods were bound by time and activity (Creswell, 2013). This study was undertaken after the 2014 Ebola epidemic that exposed the unpreparedness of HCWs for a cutaneous disease and provided the single case inquiry which examined (and to understand) EMTs' level of bioterrorism preparedness.

Role of the Researcher

My role as the researcher was important in determining the credibility and trustworthiness of the study (Tavakol & Sandars, 2014). I made use of my data collection experiences in past academic research including my masters' degree program and my current job as a probation officer without appearing judgmental. Part of the strategies I used in getting rich information from the participants was using my sense of humor and showing an appreciation for the work EMTs perform (Barratt, 2012). Both strategies helped the participants to be at ease and answer the research questions in detail. I conducted the interviews using both strategies professionally and objectively without showing biases. I ensured that there was no personal bias introduced into the data collection process and assured the participants of their privacy and confidentiality. I protected the participants' privacy and confidentiality by not including their names in the research findings. I checked any personal bias by adhering to the requirements of the institution review board (IRB) of Walden University and the Belmont Report. Although

bias exists at every stage of the research and is difficult to eliminate, the goal, however, was to minimize the bias (Smith & Noble, 2014). The need to minimize potential biases was the reason I conducted the research in another county rather than the County where I reside. I also made no assumptions of what the participants said. Rather, I sort clarifications when I was not sure of what any participant was saying or meant. Finally, I avoided potential personal bias by reviewing government policies and resources from the NJOEMS, NJDOH, and NJMRC to familiarize myself with their BT/ER practices and policies.

I acquainted myself with the study participants and the nature of their work to build a trusting relationship which helped increase the participants' willingness to provide accurate and rich information (Caretta, 2015). Although the close relationship I established with the study participants was important, it posed some challenges for me as the researcher both cognitively and emotionally (Postholm & Skrovset, 2013). The challenge helped in navigating between my role as the researcher and the familiarity with the participants and still maintain neutrality. To overcome these challenges, I exhibited emotional maturity and exceptional interpersonal attributes that helped effectively gather data and use the data to describe the phenomenon (Collins & Cooper, 2014). Part of the interpersonal attributes included maintaining eye contacts and not showing or making gestures but skillfully and attentively listening to the participants throughout the interview (Collins & Cooper, 2014).

I took issues of ethical concerns and conflicts seriously and avoided them throughout every stage of the study. Ethical concerns vary. Ethical concerns are assessed

on the goals of the study, the data collection techniques, and the setting of the study (Roberts, 2015). One of the ethical issues was obtaining signed informed consent form from the participants. The informed consent form clarified areas of potential conflicts of interest, the purpose of the research, the funding of the research (if any), the data collection procedure, and the manner of reporting and protecting participants' information and data collected.

Ethical issues also included avoiding harming the participants (Ahern, 2012). According to the Belmont Report, not harming the participants means protecting vulnerable research participants. However, I do not foresee my study posing any harm to the participants. I informed the participants of their fundamental rights to withdraw or not answer any question at any time throughout every stage of the interview.

Methodology

This qualitative case study was embarked upon to examine and understand the bioterrorism preparedness practices of EMTs especially after the Ebola epidemic of 2014 that exposed HCWs bioagent unpreparedness and policy lapses (Shultz, Baingana, & Neria, 2015). To help the understanding of EMTs' BT/ER readiness, I used Kingdon's multiple stream theory (MST). The theoretical framework views a window of opportunity as critical to initiating new policies and practices, and it is pivotal to the examination of the EMTs' bioterrorism preparedness (Ackrill, Kay, & Zahariadis, 2013). The theoretical framework helped the study understand the problems, the policy options and the politics inherent in formulating new bioterrorism preparedness practices and policies.

Participants that I selected were those who have at least five years of emergency response experience. The major sources of data were interviews (semi-structured), observation, and review of emergency response documents. The use of many sources of data (data triangulation) helped the trustworthiness of the study. In addition, stating in detail the research procedures including participants' selection, data gathering, instrumentation, data analysis techniques, and ethical concerns further enhanced the content validity, trustworthiness, and replicability of the study.

Participant Selection Logic

I used purposeful, snowball sampling technique in identifying and selecting the initial 24 emergency medical technicians (EMTs) from EMSOs in a particular county in New Jersey who met the criteria for participation. The technique helped the study get the best information from EMTs who are representative of the sample population and had adequate theoretical and practical knowledge of the phenomenon studied and facilitated the understanding of the problem and the research questions (Creswell, 2014; Frankfort-Nachmias, 2008; Robinson, 2014). The researcher deciding whom to select and the site for the study are critical aspects of the qualitative research (Maxwell, 2013). I was introduced to the organizations' supervisors and managers by a county deputy coordinator of Office of Emergency Management Services (OEMS). The participants' demographic survey forms (Appendix B) were used to identify the participants who met the study requirements. First, the organizations' supervisors used the Form to identify potential participants that met the requirements. The identified participants then

completed the forms. From the list of the returned completed demographic forms, I selected the study 18 participants and two pilot study participants.

Each organization was limited to four participants but not more than five participants. After the participants were identified by the supervisors, I emailed to the potential research participants an invitation to participate in the study and attached the cover letter (Appendix A) and the participant demographic forms (Appendix B). In the email, I thanked them for agreeing to participate in the study. I used the cover letter to introduce myself, state the reason for the study, benefits, and summary of the research, and assure the participants of their confidentiality which helped maximize data generation (Rowley, 2012). The cover letter also indicated that their participation was voluntary. I called each participant to explain further the content of the cover letter and agree with each participant the date, time and place for the interview. Later, I emailed the consent forms to the selected participants and explained the selection criteria to them. Before the start of each interview, the participant completed and signed the consent form which I collected and gave them copies.

Although I selected 24 participants, I interviewed 18 research participants. The 18 participants enriched the study with adequate information until thematic saturation occurred. The number was apt, and it ensured that adequate and diverse emergency response experiences were gathered from many organizations rather than from one organization. However, some studies have recommended a different number of participants until thematic saturation occurs. For instance, Creswell (2014) recommended between four and five participants while Gentles, Charles, Ploeg, and McKibbon (2015)

recommended between 20 and 25 interviewees. For my study, there were an extra six participants. Two of the participants were used for the pretest or pilot study. The remaining four alternate research participants from the pool of six participants were extras for additional recruitment of participants. For instance, the extra participants were potential sources of replacement if any participant dropped out of the study. The criteria for inclusion in the study included at least 5 years of emergency response experience. Other criteria included active emergency medical technician during the 2014 Ebola epidemic, at least 25 years old at the time of the interview and involvement in transporting patients to HCFs.

Determining the number of research participants for data saturation was important. However, there is no definite number of research participants for a study to attain data saturation (Fusch & Ness, 2015; Hennink, Kaiser, & Marconi, 2017). Data saturation is attained when no new information or further coding are possible or needed (Fusch & Ness, 2015). Burmeister and Aitken (2012) observed that saturation is not about sample size rather what constitutes the sample size guides the study in reaching data saturation point. Therefore, knowledgeable and experienced study participants with rich and thick information selected through purposeful, snowball sampling technique aided the study to attain data saturation (Creswell, 2014). Another method I employed to attain data saturation was data triangulation. Data triangulation, the process of gathering data from multiple sources, also helped the reliability of the study and finding (Fusch & Ness, 2015). Therefore, the information from the 18 participants, the field notes, and documents reviewed ensured the study attained data saturation and reliability.

Pilot Study

In qualitative research, there is no one way of conducting interviews or developing an interview protocol. But because the data collection instruments were researcher-developed, there was the need to pretest the instruments to ensure that they measured what they intended to measure. The pilot test provided me the opportunity to review the interview questions, modify the interview protocols and, provide the data that could help improve the conduct of the main interview procedure (Mok, Lau, Lai, & Ching, 2012). When conducting a pilot test, whether for a qualitative or quantitative study, the goal is to help improve the validity and reliability of the research instruments, and, therefore, the study findings (Cope, 2015; Dikko, 2016).

I selected two participants for the pilot study from the first selected EMSO. The two pilot study participants were identified by their respective supervisors using a purposeful sampling technique. Participants completed the participants' demographic survey form to ensure that they met the requirements for participation in the study. I emailed the cover letter and the informed consent forms to them. My initial contacts with the pre-test participants were via emails. I conducted a face-to-face interview for the pretest at their workplaces at a time most convenient for them to participate in the interview process. I recorded the session with an ICD recorder. The pilot test session also helped me assess the functionality of the recording equipment. The data collection procedure I used for the pilot study guided me in determining the effectiveness of the interview procedure and its efficacy for the main study (Cope, 2015). However, I did not include the data collected during this pilot test into the main study data analysis.

Procedures for Recruitment, Participation, and Data Collection

The research instruments I developed for data collection included participants' demographic information form (Appendix B), cover letter (Appendix A), informed consent form, and the interview questions (Appendix C). The 18 EMTs that I selected formed the primary source of data gathered through a face-to-face interview. After the interview, field notes gathered from my observations during the interview were reviewed and included in the research data for analysis. Finally, I analyzed the data collected and identified themes using thematic analysis procedure.

The core of this section centered around data collection methods. Data collection was part of the research process that described the research plan, answered the research questions that resulted in the research findings for potential practical applications (Gelling, 2015). To ensure fair representation of the EMTs and EMSOs in the selected county, I selected one EMSO each from six towns. However, only four EMSOs formed the core of the unit of analysis while the remaining two EMSOs were alternates if any of the initial four EMSOs declined to participate in the study. For the organizations' privacy and confidentiality, I assigned identifiers: Emergency Organization 1; Emergency Organization 2; Emergency Organization 3; and Emergency Organization 4. The alternate emergency organizations were not be assigned any identifiers. But if any participating emergency organization declines, one of the alternate emergency organizations would assume that identifying number.

I met the assisting supervisors in each organization in their offices and gave them the permission forms: Gatekeepers Information Form (Appendix D) and Consent and

Authorization Form (Appendix E). As the connecting link between the researcher and the potential research participants, the supervisors recommended participants who met the qualification criteria and, therefore, had a significant influence on who participated or did not participate in the study (Eslamian, Moeini, & Soleimani, 2015; Oye, Sorensen, & Glasdam, 2016). Although in some cases, supervisors could assist the participants in completing the informed consent form and, therefore, protect the interest of the organizations they represent, that was not the case about my study (Gallo et al., 2012). The study participants completed the consent forms themselves. The supervisors identified in my study included operations supervisors or managers.

The EMSOs chosen for the study had been in operation during the Ebola epidemic. The EMSOs were also purposely selected from those who operated in a pre-hospital environment. My researcher position role allowed me to examine the participants' understanding of reality from their points of view (Edwards, 2017). For the actual data collection, I allocated each week to each organization. So, for the EMSO organizations I selected and visited for the interview, I allocated between four to six weeks for the interview. The additional two weeks was to make room for spillovers. I notified each organization and their respective employees ahead of the day, time and place for the face-to-face interviews. The study questions were open-ended. I used a semi-structured interview technique, and each interview lasted for an average of 30 minutes. The 30 minutes was enough for the data gathering until no new information emerged and data became repetitive (Musheke, Merten, & Bond, 2016). Rudestam and Newton (2015) noted that open-ended interviews could yield high fidelity and little

structure when properly recorded. Both the recording and note-taking techniques ensured the accuracy of information obtained, enhanced feedbacks, improved survey instrument and increased the quality of data collection processes (Thissen, 2014).

Data Collection

Interview

I collected data through the interview of the participants, observation of the participants' mannerism and review of related documents (Creswell, 2013). The multiple sources of data helped achieve data saturation because of its rich and thick provision of information, reduction of potential bias, allowance for better assessment and applicability of the findings; and avoidance of systematic measurement error (Leuffen, Shikano, & Walter, 2013). The study interviewed the participants (EMTs) individually rather than as a focused group (Rudestam & Newton, 2015). Before starting the data collection process, I reviewed the relevant documents on emergency preparedness, responses, and policies and that gave me an understanding of what EMTs do.

I collected the data from participants using a face-to-face interview technique, and the process was recorded with two ICD recorders at their workplaces. I took notes as I interviewed the participants and was guided by the interview protocol I developed (Creswell, 2013). I used the two ICD recorders to ensure that no part of the interview session was missed and in the event one recording device malfunctioned, I will have a backup. I interviewed the participants at their respective workplaces. The interview protocols included preinterview and postinterview activities including completing participants' demographic information sheet; participants signing the informed consent

form; and member checking (Jacob & Furgerson, 2012). Member-checking measured the credibility of the study because it gave the participants the opportunity to review the accuracy of the recording and information transcribed (Houghton, Casey, Shaw, & Murphy, 2013).

The interview questions were designed to probe and to yield maximum data from the participants (Maxwell, 2013). The research questions drew inferences to the background of the study, participants' opinions, feelings, experiences and knowledge of the phenomenon under study (Greene & Yu, 2014). For instance, the central research questions guided me in formulating the interview questions. I used the interview questions in Appendix C to examine and understand EMTs knowledge of cutaneous diseases, bioterrorism preparedness and practices, and policies; the participants' experiences, knowledge and training in bioagents; understanding of existing preparedness policies and protocols; and the participants' willingness to respond to biological attacks in the aftermath of the 2014 Ebola epidemic. The questions were open-ended, and the interview was conducted in a conversational setting. Also, the selected county's all-hazard mitigation plan (HMP) of 2015 was useful in understanding EMTs' levels of preparedness for all disasters, and the emergency response protocols were also included in the interview questions.

The flexibility of the research reflected in the choice of the participants' work sites as the venues for the interview which made the participants willing study participants; made the interview convenient for them, and easier for me as the researcher to reach them (Woith, Jenkins, Astroth, & Kennedy, 2014). I conducted a pilot test that

measured the validity of the interview protocol in the field and thus improve the content validity of the interview instruments such as the research questions and the coding system for the final study (Dikko, 2016). I used the research interview questions for the pilot study as well.

I scheduled and conducted the interviews between Mondays and Fridays during office hours between 10.30 am and 9.30 pm. The flexibility of the days and hours allowed the participants to choose the most convenient day and time for the interview. The flexibility of both the interview days and hours ensured that the interview did not interfere with the participants' work schedule and negatively impacted on the organizations' emergency response functions.

After each interview, I thanked the participants for their participation and conducted a debriefing session with them. I used the debriefing sessions to clarify any issue or issues of concern with the participants: concerns that may have arisen in their minds after the interview began especially about the aim of the study although this was stated earlier (Roche & Hefferon, 2013). I asked them if they have questions about the study and the interview. I also used the debriefing to ask if any participant needed counseling. I informed them that there would be a follow-up meeting with them in-person for a review of the interview transcript to ensure the data reflected their views in the form of member-checking.

The process of member-checking allowed the participants to review the transcription of the interview; verify and confirm the accuracy of the transcribed interview; and enhance the credibility of the research (Birt, Scott, Cavers, Campbell, &

Walter, 2016; Houghton et al., 2013). I did the member-checking by meeting with the participants with a copy of the transcribed interview and have them go through it.

Observation

An observation was another data collection technique I used in gathering data from the participants, and it involved taking field notes on the behavior and body expressions of the research participants (Creswell, 2014). I used observation sheet to document my observations of the research participants' mannerism before, during and soon after the interview such as the participants' body language and facial expressions (Antin, Constantine, & Hunt, 2015) to avoid missing critical details. The observation sheet was a log that I used to document observations that were relevant to the study but not captured in the audio recording devices such as body expressions and for further inquiries (Edwards, 2017). The triangulation of data from these data collection techniques: interview protocols, observations, audio-recording, and observation log assisted in giving the study its trustworthiness and credibility (Edwards, 2017).

The issue of validity in any qualitative research depended on "the ontological and epistemological views of the researcher" and the nature of the study (Green, 2015, p. 68). Therefore, my role as the researcher involved self-reflexivity that helped me check any held personal and potential bias that would have affected the validity of the data collection (Berger, 2015; Green, 2015). Another critical issue about validity is transformational validity which refers to the outcome of the qualitative research through the participation of the respondents and collaboration throughout the research (Thomas, 2017). Validity is the extent to which the research processes including the data collection

tools and data interpretation are presented, devoid of distortion and biases (Leung, 2015; Teusner, 2016).

The researchers' held views (human cognition) arises from bias, and these views have the potentials to distort the findings in any study. As Suter and Suter (2014) observed, researcher bias affects the validity of any study because human cognition based on bias emanates from faulty reasoning or assumptions. For instance, I held the view that EMTs only transport patients to HCFs. When conducting the interview, I was open-minded and avoided rushing to conclusions as the participants provided answers to the interview questions and this mindset help avoid compromising the data and finding.

Data Analysis Plan

This qualitative case study approach was used to collect and analyze data and examine the issue of bioterrorism preparedness and ensure that the participants' experiences and perception of the phenomenon were accurately captured (Kornbluh, 2015). Data analysis involves data collection, coding, emerging themes, interpreting the findings and determining the validity of the findings (Gaglio, Glasgow, & Bull, 2012). To achieve this, I used open-ended interview processes to get answers (data) to the research questions from the participants; and I transcribed all the answers to the research questions verbatim (Gaglio et al., 2012; Chan, Fung, & Chien, 2013). I also compared the audio recording with the notes I took during the interview.

I began the data analysis with the collection of the data from the various sources: recorded interviews, field notes, and documents gathered from NJOEM and a county emergency management office. The interviews were tape-recorded using ICD recorder,

later transcribed verbatim and finally conducted a qualitative thematic content analysis through the coding of the data (Mehraban, Hassanpour, Jamdani, & Ajami, 2013). The process of data transcription involves text search, coding queries, and matrix queries ((Houghton et al., 2013). I listened to the recorded interview many times before beginning the process of transcribing the recorded interview, word for word (Zeighami, Oskouie, & Joolaee, 2014). I then segmented the collected data question by question for each participant using the text search method, reviewed the recorded interview and the notes I took and identified the key terms or ideas that formed the primary codes (Vaughn & Turner, 2016; Zeighami et al., 2014). The segmentation of the data question by question was necessary because of the expected volume of data involved in the process of data analysis and for a clearer understanding of the data and the transcription (Vaughn & Turner, 2016). Next, I used coding queries to reduce the large segments and labeled them into codes which I stored in the nodes for references (Houghton et al., 2013). Later, the related codes were reduced into sub-themes, and the sub-themes further categorized into themes (Zeighami et al., 2014). Finally, the matrix coding was used to identify and compare numerous nodes or themes and confirm findings to ensure the participants' information was accurately reflected (Houghton et al., 2013). Data coding is an important procedure in a qualitative study because, in an open-ended interview procedure, coding helps show emerging patterns and themes (matrix queries) from the participants' response to the research questions (Rapport, Clement, Doel, & Hutchings, 2015).

Data analysis requires an understanding of the entire process of data mining, organizing data, and developing reflective memos to increase data interpretation

(Finfgeld-Connett, 2014a). Memoing was important to this study because I used it to encapsulate concisely, clearly, and transparently my understanding of the generated data as to arrive at findings that also reflected the participants' views of the phenomenon (Finfgeld-Connett, 2014b). To develop the themes, the software *in vivo* coding technique was utilized. The usefulness of *in vivo* as a computer-assisted qualitative data analysis software is to assist the researcher in data coding, retrieval and recording, editing, and filing of data (Roberts, Breen, & Symes, 2013). Essentially, the software program assisted me in data coding and analysis while I remained the major instrument throughout the data collection and analysis stages (Habib, Etesam, Ghoddusifar, & Mohajeri, 2012).

Another critical element in data analysis that I included while reviewing the data was the discrepant cases and non-conforming data. These were cases and data that though did not fit into the data categorization or emerging theme but were nonetheless considered for better thematic data analysis (Waite, 2011). I reflected the discrepant data in the study's finding because they were equally relevant for a clearer understanding of the data I collected and the findings of the study.

Issues of Trustworthiness

Trustworthiness in qualitative research involves the verifiability of the data, researcher accounting for or acknowledgment of bias, data triangulation, clear description of the data gathering and analysis processes (Noble & Smith, 2015). Trustworthiness was measured with the four yardsticks or criteria of dependability, confirmability, transferability, and credibility rather than the quantitative measuring tools of reliability and validity and generalization (Morse, 2015). White, Oelke, and Friesen (2012) noted

that trustworthiness and careful management of data are critical elements in inductive qualitative research such as my study. The four criteria for assessing the trustworthiness of a qualitative study were developed by Guba and Lincoln in the 1980s replacing such terms as generalizability, reliability, and validity (Morse, 2015).

To ensure the trustworthiness of the study, I adopted an open-ended and iterative line of questioning along with data triangulation, participants selection process and context of the study clearly stated, and data accurately reflected participants' actual views (Cope, 2014; Mabuza, Govender, Ogunganjo, & Mash., 2014).

Credibility (Internal Validity)

An inductive research such as my study draws its credibility from the trustworthiness of the entire gamut of the data analysis process namely, data triangulation, participant selection technique, member-checking, peer-review of the process (Connelly, 2016; Whyte, Burke, White, & Moran, 2015). Credibility is the equivalent of internal validity for quantitative research. Credibility measures how the researchers' interpretation of the data collected meshes with participants' information given during the interview (Munn, Porritt, Lockwood, Aromataris, & Pearson, 2014). In assessing the credibility of my study, I made painstaking efforts to ensure that I accurately interpreted the data and arrived at findings that reflected the actual data collected from the EMTs interviewed. I employed the following techniques: exhaustive interview of the participants, keen observation, and note-taking of body language, review of journals, member checking, purposeful selection of knowledgeable EMTs for the study's credibility (Connelly, 2016).

The study adopted a semi-structured method to conduct the interview. Also, to select knowledgeable participants, the snowball purposeful sampling technique was utilized to increase the credibility of the finding (Ahern, 2012; Smith, & Herber, 2015). The snowball purposeful sampling technique gave the study credibility through the sampling of information-rich participants who had deep knowledge, experience, and understanding of the phenomenon under study (Palinkas et al., 2015). In applying this selection technique, both the gatekeeper (supervisor) and the other research participants assisted in identifying individuals who were both knowledgeable and willing to participate in the research. The research participants were drawn from EMTs rather than from other emergency medical responders such as mobile intensive care nurses, paramedics and Advanced EMTs.

Transferability (External Validity)

Transferability refers to the application of the findings of a study to another setting or other contest (Moon, Brewer, Januchowski-Hartley, Adams, & Blackman, 2016). I provided a detailed description of the phenomena under study; the participants' recruitment procedure and the inclusion criteria, the data collection processes, data triangulation, duration of the interview session, and where and when the interview took place. Triangulation of data helped the study achieve transferability. The extent to which examining and understanding EMTs bioterrorism preparedness, from a small study population in a particular county, could be replicated and extrapolated to other Counties was what made the study trustworthy from a positivist perspective (Moon et al., 2016).

The transferability of a study to another situation is, however, complex because the sample size is measured not only by the number of study participants but also the adequacy and usefulness of the data **(**O'Reilly & Parker, 2013). The transferability of my study to another setting might be limited by the sample size and heterogeneity of the participants. The transferability (external validity) could, however, be enhanced if the nature and process of research inquiry are well defined. Hence I provided detailed information about the research method to help future research on the phenomena or similar phenomena.

Dependability (Reliability)

Dependability in inductive research is the measure of the consistency of the research design process throughout data collection, analysis, interpretation, and reporting of the findings (Connelly, 2016; Houghton et al., 2013). Dependability also involves a detailed audit trail of process log about the research activities including the research participants' selection process and conduct of the interview (Connelly, 2016). I ensured the dependability of the study by creating an audit trail for tracking and keeping detailed records, approaches and activities involved in the research process (Connelly, 2016; White, Oelke, & Friesen, 2012). The audit trail I developed during the interview helped me keep track of the relevant activities that happened throughout the study for reference purposes.

Member checking is another technique I used to improve the study's dependability. I utilized member checking to check back with the research participants with the transcribed interview to ensure it reflected their views (Houghton et al., 2013;

Kornbluh, 2015). I also used member-checking, a validation technique to establish the dependability and credibility of the result of my study (Birt, Scott, Cavers, Campbell, & Walter, 2016). I did this by returning to the participants several weeks after the interview for them to check the accuracy and consistency of the data and information they provided.

Confirmability (Objectivity)

Confirmability as a measure of the trustworthiness of the study is to find out if another researcher who is not privy to the original study can arrive at the same finding with the same data rather than the researcher's assumptions (Rapport et al., 2015). The independent replication of the study helps the researcher check for any bias that may have been unwittingly introduced into the study. Confirmability should measure the objectivity of the study based on the actual data collected from the participants rather than the researcher's preconceived ideas and opinions. Although, as the researcher, I stated my beliefs, assumptions, and predispositions towards the phenomenon under study, it may not have necessarily eliminated the potential introduction of bias (Moon et al., 2016). However, I reduced the possibility bias of prejudgment of EMTs knowledge by maintaining unbiased disposition and not make any assumptions of the research findings. I also achieved the confirmability criterion of the study by using data triangulation and member checking to ensure the accuracy of the data gathered from the participants and the credibility of the findings.

Ethical Procedures

I conducted this study with IRB Approval No. 02-26-18-0441760. Ethical considerations ensure that personal bias is minimized through member-checking because the researcher is ethically required to reflect participants' views and lived experiences accurately (Kornbluh, 2015). In every research, the researcher is also required to protect the participants' confidentiality, privacy, and rights throughout the research process (Petrova, Dewing, & Camilleri, 2016). Qualitative research involves the interaction between the researcher and the research participants. So, I abided by the Belmont Report. The Belmont Report emphasized that researchers adhere to three principles: respect for persons (informed consent); beneficence (not harm); and justice (protect vulnerable subjects) (University of Iowa: Human Subject Office, n.d). Throughout the participants' selection process and interview, I also abided by the Walden University review board (IRB) requirements including obtaining signed informed consent form, the protection of the participants' rights, identity and privacy, and confidential and personal information (Smith & Herber, 2015). The informed consent form contained the interview procedure, the purpose of the study, and the language made clear, comprehensive and readable to ensure the participants understood the nature of the study (Foe & Larson, 2016).

The ethical procedure also requires that I state how the interview will be conducted which also included the duration of the interview, audio recording procedure, and the participants' right to terminate the interview or withdraw if feeling uncomfortable or unable to continue (Green, Darbyshire, Adams, & Jackson, 2016). In line with the Belmont Report, IRB's requirement, and ethical requirement, the subjects were not be

harmed by the study (Ahern, 2012). I made provisions for professional assistance in the event the questions and interview process caused some harms or distress to the participants as they relieve their emergency response experiences (Hegney & Chan 2010). I also provided the participants with the toll-free number 800-233-4357 for any crisis and 800-999-9999 for depression cases.

Another aspect of the ethical procedure was research materials protection. Interview materials including the recording devices and field notes were stored in a safe box, and the information in the computer encrypted and password accessible only by me. The data and information protection mechanisms were to avoid a third-party accessing them and to protect the participants' information, maintain their privacy and confidentiality. I informed the participants that the research data and materials obtained from them would be retained in confidentiality for five years after the study and then destroyed. After five years, the recording devices will be destroyed, the data deleted from the computer, and the documents shredded.

Summary

In this chapter, I discussed the rationale for research design: inductive qualitative case study approach. The critical element in a qualitative study is the open-ended questions conducted via a semi-structured technique for which my role as the researcher was pivotal. My role was the principal instrument for data collection and, therefore, critical for the trustworthiness of the study. I discussed the other pertinent issues in research method including the pilot test, the recruitment of participants for the study, data collection methods, data analysis, and ethical issues. Important in this qualitative study

was establishing the study's validity and credibility through trustworthiness and data management (White et al., 2012).

In the next chapter, the focus is on conducting the actual study beginning with the pilot study and data collection including the setting for the interview protocol, and data analysis procedures. The chapter addresses how the pivotal issues of trustworthiness: credibility, transferability, dependability, and confirmability relevant to a qualitative study were met. Finally, the study addressed the issues of discrepant data because they were equally important in data analysis.

Chapter 4: Findings

Introduction

The 2014 Ebola epidemic that started in the West African subregion reached the United States and created hysteria. The response from the medical community and the various levels of government revealed apparent disjointed policy towards potential biological attacks. The uncoordinated approach towards the epidemic and the fear that pathogens such as smallpox, anthrax, and Ebola could be weaponized demonstrated the need to examine the preparedness and response readiness of EMTs, who are the first medical responders when disasters strike. There was also the need to determine the best strategies for bioterrorism hardening. The study sought to examine and understand the nature and level of bioterrorism preparedness among EMTs in New Jersey, for cutaneous forms of biological agents such as EVD, and the attendant policy and political implications of inadequate preparedness or a lack of preparedness.

The research questions used for data collection were as follows: Are EMSOs and EMTs in the counties prepared for a cutaneous form of biological attack such as EVD? What are the policy and political implications of lack of preparedness? They were designed to examine the preparedness and emergency response practices of EMTs in a particular county and to identify factors New Jersey's policymakers, and EMSOs would consider for bioterrorism preparedness within EMTs operations for community-wide bioterrorism hardening. The study examined the bioagent knowledge and preparedness of EMTs. I interviewed participants who were active EMTs during the 2014 Ebola epidemic to understand their knowledge of bioagents, bioterrorism preparedness, and practices in

their respective organizations. Furthermore, the research focused on the obstacles that affected EMTs' readiness and what they believe should be the emergency response protocols for effective bioterrorism response practices.

In this chapter, the participants' information was transcribed and stored in a computer and the following areas were addressed: the pilot study, the participants' recruitment process, data collection process, the participants' interview response from which the themes emerged, data safeguards, data analysis, and the issues of trustworthiness. Following the data analysis, these eight themes emerged: adequate planning and preparedness, lack of resources, inadequate knowledge and information, continuous education, mandatory bioterrorism training, collaboration among agencies and safety and job security.

Description of the Pilot Study

I conducted a pilot study. I used two EMTs for the pilot study. The EMTs used for the pilot study were not included in the subsequent interviews for the actual research. The purpose of the pilot study was to help fine-tune the research instruments and determine if changes were needed. The two pilot study participants were interviewed in the evening between 6.00pm and 9.00pm. After administering the demographic survey information sheet, I determined that they met the requirements to participate in the study. I conducted face-to-face interviews with the pilot study participants. The pilot study had an impact on the substantive interview because it helped me to acquaint myself with how to use the data collection instruments: the tape recorder, the information sheet, and the delivery of

the interview questions. It turned out that no research instruments changes were needed, and the questions were adequate for the study.

The Setting

The venue for the interview of the participants was the respective meeting or conference rooms of the organizations that participated in the study. None of the research participants agreed to participate in the study outside of their respective organizations because they wanted the interviews conducted during their work shift hours. The organizations' supervisors also agreed to that arrangement. The interviews were conducted in the evening between 4.00pm and 9.00pm. The reason for this was because most of the participants were either volunteers or had other daytime jobs and, therefore, reported to their respective emergency services assignments in the evening.

The Demographics

I used the organizations' supervisors and managers to gain access to the research participants in their organizations. The participants were selected using purposeful, snowball sampling technique. The organization supervisors acted as the point persons in each organization and were approved by the Walden University Institution Research Board (IRB). The data used in this study emanated from a total of 18 EMTs. I received the IRB authorization to use these organizations for the study. Six organizations were identified and approved by the IRB. Although six organizations were identified and selected for the study, only four EMSOs were used for the study. The additional two extra organizations were placed as buffers. In the event any selected organization dropped out of the study, one of the two additional organizations would be used as a

substitute. A total of 24 participants were also identified through emails but, 20 EMTs were accepted for the study. Two of the 20 participants were only used for the pilot study. The remaining four participants were not used for the study.

The 18 participants for the study from the EMSO were selected because of their varied experiences in emergency responses, knowledge, and involvement in emergency response during the 2014 Ebola epidemic and after the epidemic. The number of participants in the youngest age group (25 to 29) was two while the participants in the oldest age bracket (42 years and above) were 12. The remainder of the 4 participants' age brackets were in between. The huge number of participants above 42 years was an indication that most of the participants were very experienced in emergency medical services and they provided useful data for the study. The average age of emergency response experience of EMTs who participated in the study was 14.63 years (See Table 1 below).

Table 1

Demographic Distribution of Research Participants

EMS Organizations	Number of Participants	Gender	Educational Level	Participants' average age	Average years of experience
Organization 1	5	Females 2 Males 3	1certificate, 3 BA & 1 above BA	38.6 years	14 years
Organization 2	4	Males 4	2 GED and 2 BA	39 years	17.5 years
Organization 3	4	Female1 Males 3	3 certificates and 1 GED	37.5 years	15 years
Organization 4	5	Female 1 Males 4	1 certificate, 1 GED, 3 BA	38.6 years	12 years
Cumulative & Average #s:	18	Females 4 Males 14	Certificate 5, GED 4, BA 8, above BA 1	38.43 years	14.63 years

Data Collection and Organization

I conducted a face to face interviews of the participants. Four participants each were selected from two organizations while five participants each were from the other two organizations for a total of 18 participants. The participating organizations were located in New Jersey and the interviews were conducted between April 23, 2018, and June 25, 2018. I designed the interview questions (see Appendix C) to assist in answering the research questions. Data transcription was simultaneously done as the data mining was going on. Soon after the data collection and transcription ended, the data analysis started.

The process of data collection began with the internet search for EMSOs. I identified about a dozen EMSOs. Next, I identified the community partners who were the EMSOs' supervisors and managers by using the referral technique. I reached out to the county emergency medical preparedness coordinator who helped narrow down the potential organizations and gave me their respective addresses. He also provided the addresses, emails and phone numbers of the contact persons in the organizations. To reach to the contacts, I visited the organizations' supervisors and discussed with them how they would assist the study. I later gave them the gatekeeper information form (Appendix D), and the Consent and Authorization Form (Appendix E) to review. Some of them required multiple visits. However, after reviewing the consent and authorization forms, they gave their consent by signing the Authorization Forms. The organizations' conference rooms were the venues of the interviews.

Some days, couple of interviews sessions were conducted in an organization the same day. In some other days, just one interview was conducted. It was practically impossible getting all participants at the same time or day. But the interviews were scheduled at a time most convenient for the participants and the organizations to avoid interrupting their workflow. Although the interview was scheduled to last about one hour, the average duration of the interview was about 30 minutes. The table 1 above shows the age distribution and average years of experience of the research participants drawn from the four research organizations.

I used a semistructured interview technique for the data collection process. Each selected participant was emailed the cover letter (Appendix A) and the participants'

demographic information survey sheet (Appendix B). After a review of the Appendix B, the qualified participants were emailed the consent form. However, the informed consent form was signed by the study participants before the start of the interview. I welcomed the participants and thanked them for agreeing to participate in the study. I also recapped in person the nature of the interview, the reason for the study, the benefit of the study, the security of the data, and protection of their privacy in accordance by the Belmont Report. I audio-taped the interview after obtaining their consent both verbally and in writing as contained in the consent form. These issues were covered in both the cover letter and the informed consent form. The study participants retained copies of the informed consent forms for their records while I took the original copies.

The participants showed an eagerness to participate in the study. Some of them volunteered that the study was useful because it was a way of expressing their views to bring about changes in emergency medical preparedness and responses. One participant, in particular, stated that he is conducting a near similar study but with emphasis on explosives and response readiness of paramedics.

After the interview, I reviewed and transcribed the information the participant provided. After the transcription, I reviewed the transcript with the participants, and they acknowledged that the data transcript accurately reflected the information they provided during the interview. The interview questions (See Appendix C) addressed the focus of the study and the research questions. The research participants were asked the same questions, and in some instances, follow-up questions were asked to ensure that the issues were properly addressed.

To ensure research material protection, interview materials including the recording devices and field notes were stored in a safe box and the information in the private computer encrypted and made password accessible only to me. This method of interview material protection ensured the participants' privacy and confidentiality. After the validation of the interview transcripts with the participants, each participant data transcript was saved in word document individually and was later uploaded into the in vivo software for qualitative analysis.

Data Analysis

The primary data were drawn from the information provided by the EMTs, who were EMTs during the 2014 Ebola epidemic. The *in vivo* software coding process was used to organize the uploaded external documents (interview transcript) and subsequent data analysis. Coding in this qualitative study was used primarily for the retrieval and categorization of similar data chunks (Matthew, Huberman, & Saldana, 2014). In the analysis, I used the participants' words or phrases to identify codes. The codes representing the participants' words were clustered together to create categories, and the categories, in turn, helped show their interconnectivity. Initially, I created five nodes: planning and preparedness, lack of resources, continuous education, inadequate knowledge and mandatory bioterrorism hardening which were placed in categories. I placed matching transcripts into the corresponding nodes.

Further review established precise patterns that resulted in more concise themes and the emergent of two additional themes: collaboration among agencies and safety and job security. All the seven themes were later placed in condensed categories. The

software in Vivo helped in organizing the unstructured data into a manageable format and identifying the themes that resonated with the study participants (Creswell, 2013; Creswell, 2015).

Examples of the responses from the participants in response to the interview question (Appendix C) are illustrated here. From the interview question 1 the following codes were identified: training, prepared and adequate and standard response leading to the theme, planning, and preparedness under the category, understanding emergency practices. Some quotes from the participants illustrated the codes. (P4, O2) stated that "they are standard" and from (P2, O2) "overall, I will rate them adequate to slightly above adequate." From the interview questions 2, 3, 4 and 9, the following codes were pronounced: funding/money, training, information sharing, insufficient knowledge, identifying pathogens and universal precautions and the themes, lack of resources, inadequate knowledge and information, and continuous education emerged under the category: impediments to bioterrorism preparedness. Some of the participants' responses were significant. (P3, P3) responded "it comes down to two things: Money and the will. Everything costs money. The political will to do it. The last bioterrorism attack was about 16 – 17 years ago. I do not know how many EMTs know what it is." (P4, O2) states "the biggest obstacle is numbers. I think we do not have enough people adequately trained and prepared versus potentially the number of victims we can be faced with." and (P1, O2) added "I do not see the bioterrorism preparedness resolve or training that l saw about ten years ago after the anthrax attacks. I think its declining. Public health, we are preparing but not like a decade ago."

From the Interview Questions, 5 and 6 these codes were identified: training, awareness of diseases, Universal precautions, and safety leading to the theme, mandatory bioterrorism hardening under the category, understanding bioterrorism preparedness. Some of the participants' responses to these questions included those by (P4, 01) "It does not prepare us at all. We only rely on what the state and the county tell us to do. If we get to a scene and have some sort of biological agent, we will kick it back to the state health department" and (P1, 02) added "The main thing is to maintain good universal precautions. We in EMS often are in a disadvantage. In my other life, I work in the hospital. In the hospital, if you walk to the door, there is a warning of the level of precaution you should take."

Finally, in response to Questions 7, 8, and 10, the study identified the following codes, regular drills, education, interagency coordination, training, funding, PPE, and information sharing. The emergent themes were collaboration among agencies and safety and job security under the category, enhancing bioterrorism preparedness and practices. Participants responses included the following: For Question. 8, (P1, O2) stated "There are not a lot of bioterrorism classes anymore. So, bioterrorism classes should be in included in the basic courses even if it is 30 minutes training. I know you are focused on bioterrorism, why not include chemical and other for forms WMD in the refresher courses so that people can maintain a high level of efficiency." For Question 10, (P3, 02) responded "I think EMS, paramedics, fire, and police should be required to have WMD policy and procedures that are reviewed by everyone. Maintain their training and

maintain their efficiency. More training and maybe more access to more protective equipment specific to biological agents type of threats."

Discrepant data

Most of the responses from the participants focused extensively on the questions asked, and that helped yield a large amount of relevant data that produced the themes discussed. In the few instances where the participants provided information that did not fully address the question, their responses, however, helped provide background information and knowledge. For instance, while answering the questions, very few deviated slightly in the middle of the response. As an illustration, in response to Question 4: What knowledge do you have about cutaneous forms of pathogens such as Ebola?, (P4, 03) gave answers that described his student life rather than his knowledge of pathogens. He talked a bit about his studies in emergency management at Jackson State University in Alabama. Although his studies in emergency management may help him in managing emergency responders when he graduates, he did not fully address his knowledge of pathogens such as Ebola. The participant's answer had no relevance to understanding his knowledge of cutaneous forms of pathogens.

The issues of Trustworthiness

The trustworthiness of the study was reviewed and measured using the yardsticks of credibility, dependability, confirmability, and transferability.

Credibility

One major element of ensuring the credibility of a study is accurately reflecting the views of the participants. To achieve this, this study recorded the interview session,

transcribed the data verbatim, reviewed it with the participants for accurate representation of their information and diversity of the participants. Munn, Porritt, Lockwood, Aromataris, and Pearson (2014) noted that for a study to be deemed credible, the researcher must interpret the data in such a way that the interpretation aligns with the information the participants' provided during the interview. Also, the participants met the requirements for participation and were active EMTs during the 2014 Ebola epidemic. The participants were also knowledgeable about the issue of emergency medical response and provided useful information.

Transferability

Although the study was conducted in one county, to ensure the transferability of the study, I provided a detailed description of the phenomena studied, participants' recruitment process, and data collection process to ensure the study's replicability in other settings or county. Part of the process of ensuring the transferability of the study was in clearly documenting the research process such as how the participants were selected to ensure that they were qualified, and the nature of their participation including not being paid. Criteria for participation were documented and reviewed with the participants before the interview.

Dependability

The processes involved in the study: research participants' selection, data collection techniques, data transcription, data analysis, interpretation, and the reporting of the findings were documented as a way of measuring the consistency of the research design. The participants' selection process was carefully done to ensure that the

participants were both knowledgeable and met the requirement for participation. A detailed audit trail was used to ensure that the study's findings were dependable (Connelly, 2016). Audit trail involved accurate documentation of the process of the research process. Also, for the dependability of the findings, I ensured that the research questions, the purpose of the study, the research design and the study's theoretical framework meshed. I also adopted the member-checking approach by returning to the participants with the transcribed data for data consistency. Only two of the study participants requested corrections to certain areas of the data transcript.

Confirmability

Confirmability as a measure of the objectivity of the study was ensured by accurately reflecting the information provided by the participants devoid of the views and biases of the researcher (Rapport et al., 2015). I collected the data and carefully documented the research process for independent replicability of the study and conducted member-checking with the participants for the accuracy of the data. Data triangulation was also used for the confirmability of the study.

Results

After the interview, I transcribed, member-checked the transcript and analyzed the data. The participants' information during the interview established the relation between the central question and the theoretical framework (MST) from which several codes were identified, and the seven themes emerged. For instance, from the perspectives of the participants, the codes: training, awareness, personal protection equipment, universal precaution, and preparedness were identified as instrumental to understanding

bioterrorism preparedness leading to the emergent of the theme: mandatory bioterrorism hardening. The interview questions in conjunction with the theoretical framework and the literature review also helped in developing the four broad categories: understanding emergency responses and practices, barriers to bioterrorism preparedness, understanding bioterrorism preparedness and enhancing bioterrorism hardening. Then I aligned the codes, themes and, categories with the research questions and the theoretical framework. Table 2 below shows the relationship between the codes (14), the themes (7), the categories (4). MST and the research questions.

Table 2

The relationship between codes, themes, categories and research questions.

Categories	Theme	Codes	Research Questions
Understanding emergency practices	Planning and preparedness	Training, prepared & adequate, standard response	*Question 1* *Politics stream*
Impediments to bioterrorism preparedness	Lack of resources; Inadequate knowledge & information; Continuous education	Funding/money; training; information sharing; insufficient knowledge, identifying pathogens, universal precautions	*Questions 2, 3, 4 & 9* *Problem stream*
Understanding bioterrorism Preparedness	Mandatory bioterrorism hardening	Training; awareness of WMD; universal precautions; safety of the responders	*Questions 5 & 6* *Politics stream*
Enhancing bioterrorism preparedness and practices	Collaboration among agencies Safety & job security	Regular drills; education; interagency coordination; training; funding; PPE; information sharing	*Questions 7, 8, & 10* *Policy stream*

To buttress the codes and themes, some of the participants' exact information was reproduced along with the emergent themes during the explanation of the findings. Table 3 showed the codes and their frequency of occurrences and Table 4 depicted study participants' identifiers.

Table 3

Graphic Representation of the Themed Responses to the Interview Questions.

S/No	Codes	Frequency	% of occurrences
1	Training	102	25.44
2	Prepared and adequate	35	8.73
3	Insufficient Knowledge	34	8.48
4	Information sharing	32	7.98
5	Awareness of diseases	29	7.23
6	Education	27	6.73
7	Personal protection equipment (PPE) maintenance	23	5.74
8	Money/Fund/Resources	23	5.74
9	Regular drills	18	4.49
10	Safety	18	4.49
11	Identifying pathogens	17	4.24
12	Universal precautions	16	3.99
13	Standard response	15	3.74
14	Inter-agency coordination	12	2.99
	Total	401	100%

The responses to the questions were varied, but they pointed to clear directions with constant phrases or words that led to the emergent of training, preparedness/prepared, knowledge and information as the dominant coded data. Almost all the participants were of the view that these codes training, knowledge and information sharing were needed for bioterrorism preparedness and hardening. Although the safety concern was not as dominant as some other codes, the participants believed that safety

issues such as adopting universal precautions were crucial to effective emergency response. For instance, on Question 5, Participant 1, Organization 3 (P5, 03) stated: "Again, it goes back to our basic training. That our safety is first and foremost in our response. So, to know what we are going into is always very important." P5, O5 shared a similar thought when he stated "once you get there, you have to make sure the scene is safe. Most importantly, the safety of your crew is most important." Similarly, despite the overall lack of adequate knowledge of bioagents among the participants, four participants (P1,O2; P3,O4; P1,O4, and P4, O3) expressed adequate or partial knowledge of bioagents because of their other full-time jobs in the hospitals unlike their volunteer or paid colleagues who lacked such knowledge.

Table 4

The participants identification markers

S/N	Organization 1 (O1)	Organization 2 (O2	Organization 3 (O3)	Organization 4 (O4)
1	Participant 1 (P1)	Participant 1 (P1)	Participant 1 (P1)	Participant 1 (P1)
2	Participant 2 (P2)	Participant 2 (P2)	Participant 2 (P2)	Participant 2 (P2)
3	Participant 3 (P3)	Participant 3 (P3)	Participant 3 (P3)	Participant 3 (P3)
4	Participant 4 (P4)	Participant 4 (P4)	Participant 4 (P4)	Participant 4 (P4)
5	Participant 5 (P5)			Participant 5 (P5)

Illustration of table 4. The organizations and the research participants were not identified by name. They were assigned identifiers as Table 4 shows. For instance, the first organization was identified as organization 1 and the first participant interviewed in organization 1 was identified as participant 1 and abbreviated thus P1, O1. The identification followed that trend until the last organization (O4) and the last participant of the organization (P5) abbreviated thus (P5, O4).

Summary of the findings:

The following are the initial summary of the findings based on the codes, emergent themes, the research questions, and the critical aspects of MST: problem stream, politics stream, and policy stream.

1. Despite the 2001 anthrax incidents and the 2014 Ebola epidemic, there was an apparent lack of sustained bioterrorism preparedness although the emergency organizations were prepared for other emergencies (Problem stream).
2. Although the problems existed, there was a heightened level of caution and emphasis on universal precaution and safety which are critical to any emergency response (Politics stream).
3. The participants believed that increased funding, inter-agency collaboration, drills (training) and continuous bioterrorism awareness and preparedness were needed for a new approach towards bioterrorism hardening (Policy stream).

The presentation of the themes and the responses from a cross-section of the participants helped paint a picture of the current emergency medical responses and practices and proffer what needs to be done to protect both the EMTs and the community.

Problem Stream

I found that the impediments to bioterrorism preparedness included lack of resources, inadequate knowledge, and insufficient information sharing and continuous education. In other to address these problems, the finding supported the need for adequate funding, increased training and information among emergency medical responders.

Theme 1: Lack of resources

Question 2: How would you describe the preparedness practices in your organization for biological attacks especially after the 2014 Ebola epidemic?

Lack of resources emerged from the participants' references to money/funding, and training in the context of lack or inadequate training were mention multiple times while responding to the interview Questions 2. Almost all the participants mentioned training in some way while responding to most of the questions. Hence, training was mentioned most: 102 times representing 25.44 percent of the codes. Lack of funding was mentioned 23 times representing 5.74 percent of the entire codes as illustrated in Table 3. Lack of or inadequate funding was the seventh most mentioned code. This suggests that it was a critical issue among the participants for effective emergency response and their safety. On Question 2, P1, O3 stated that "Again, I will say we are above average. Like most other agencies of our size, some of it is hampered for monetary reasons. But for the most part, I will say that we are above average if not over an average for agencies of our size." I followed up the response with this question: "You said hampered by monetary reason, how can you explain that?" He responded, "Just that it is an expensive continual

process to make sure we are staffed with particularly up to date PPE that we can find. Unfortunately, that stuff expires. So, the need to replace it comes into play."

Two participants particularly mentioned "poor" in describing their organizations' bioterrorism preparedness. Pushed further for explanation, P4, O1, stated that lack of education was responsible for the inadequate preparedness which was traceable to poor funding. Lack of education presupposed poor knowledge of bioagents and bioterrorism mitigation protocols. P4, O3 stated "We have fit-tested with N-95 mask. Certain members of my organization have been fit-tested for a full CBRNE mask. We were fit-tested once. We never received training on the equipment. Majority of the people never received training on the equipment. There is no annual training to do that. And, I know that it is crucial. A lot of that is due to funding and manpower." Similarly, O4, P3, informed that "not every person is trained to the same level for biological response (or) has the same level knowledge of the appropriate PPE necessary to respond to a biological attack." Others noted that they neither conducted drills nor trained for bioterrorism or bioagents They trained rather for improvised explosive devices (IEDs).

Similarly, information from the participants noted that the heightened awareness and precautionary measures of biological agents during and immediate years after the Ebola epidemic but as the threat went down the awareness level dropped. These observations were linked to insufficient knowledge of bioagents and inadequate training and preparedness for bioterrorism.

Theme 2: Continuous education

Question 3: How will the knowledge of bioagents help you in emergency responses that involve cutaneous diseases?

Question 4: What knowledge do you have about cutaneous forms of pathogens such as Ebola?

Both questions were interrelated, and the responses from the 18 participants led to the theme: continuous education. The responses of the participants point to the lack of adequate knowledge of pathogens. Although, they recognized the importance of such knowledge for their safety and their families. The participants recognized the importance of training and regular education to identify and separate pathogens when responding to disaster scenes. On Question 3, P4, O1 responded that "I mean, it is not something you will suspect immediately you walk to the scene. Ok, this person is exposed to anthrax. I mean, effectively identifying it. Obviously, you will need a lot of training in that. Or somebody else exposed outside to something that could be airborne, you will know immediately, ok, this is what I want to do to effectively treat this patient and then contact medical control."

P5, O1 stated knowing "how to identify certain biological agents, anthrax versus Ebola versus smallpox to normal things that are still contagious. Small things like lice that are more common and treatable than biological agents. So, it starts with the simple things to the more severe things. So, knowing biological agents and the training will enable us to respond, treat and continue treating, and (know) how to prepare, if the knowledge is there." P2, O3 responded, "Well, that was one of the things we learned after Ebola outbreak. We were educated on certain things like Ebola, scarlet fever, a lot of

highly contagious diseases that we may have passed over were made aware of. We focused on re-educating the people. Like it became more apparent that ok, back in the day, you get a little vomit, you clean it up. But training and education are not done." One particular participant (P2, O2), alluded to acquiring his knowledge of pathogens from fictional books in response to question 4. He stated, "Minimum knowledge. Just what I have read in magazines, periodicals. I read about a Tom Clancy novel called Executives Orders (A fictional novel). The way they described the disease was interesting and similar to what I have read about germs." Responses to these questions reveal the concerns of the participants because as the years pass their acquired knowledge declined, and their safety and performance become compromised.

There was also the concern that effective performance of their job will have a lot to do with the public having education and information on what they are reporting. In particular, one participant (P1, O3), expressed the need for public education because of its pivotal role in information dissemination to responders which will help in effective emergency response and the protection of EMTs: "I think better educating the public. There are many times that we will only have the information that is giving to our dispatchers. I think the more people have a better understanding and education of incidents like this; they will be better able to convey that information to our dispatchers who will then give us better information. So, the public help end of it is a major problem." So, in this instance, it is not only about educating the emergency responders, but it also about educating the public so that EMTs can be better prepared to protect themselves and the community.

Theme 3: Inadequate knowledge and information

Question 9: What would you say are the major obstacles for an effective emergency response involving infectious diseases?

This theme emerged out of the general feeling among the participants that in spite of the amount of preparedness for bioterrorism immediately after the 2014 Ebola epidemic, no concerted effort was made to sustain the level. Now and then the participants went back to the issues of inadequate funding, lack of knowledge and insufficient information sharing either with the public or among the other emergency responders. The major codes that contributed to this theme were knowledge (34) and information (32) representing 16.46 percent of the total occurrences. They were among the top five occurrences. These occurrences illustrated their importance regarding getting the emergency responders prepared. Excerpts from the participants will further support this assertion. P3, O2, in response to Question 9 said, "The major obstacle is poor communication between departments. Sometimes, the information they relay to the police department is not always passed down to emergency medical services because when people call 911, the first person they speak to is the police. And as the information gets transferred, sometimes you lose some of the information along the way." P2, O3 expressed the same sentiment: "I will say the first line is the dispatch. This is very vague. You do not know what you are walking into. The first problem starts with the dispatch. When the information is not clear, the responders are in the dark about what to expect, and that has a great impact on EMTs' safety and preparedness." And she added "people who are calling in 911, they do not answer all the questions and are not paying attention.

They hang up. Also, with the Pro QUA, you cannot rely on. It is like a kind of catch 22 because you cannot rely on the people at the end of the phone because they are too confused to answer."

But one common theme by the participants is the lack or at best, minimum knowledge of biological agents. P1, O1 stated that "The biggest thing is knowing what the disease is" when asked about the obstacles in responding to potential emergencies involving infectious disease. The lack of knowledge was pervasive in most of the responses from the other participants. P3, 04, in response to Question 9 stated, "Lack of support for training. Lack of knowledge." I then asked a follow-up question: When you say lack of knowledge, what do you mean? He offered this clarification: "Lack of knowledge on how to protect yourself to that level. And the fear of saying that your organization is not prepared to respond to that kind of incident, you do not want to make that public." Other participants, while acknowledging the improved preparedness in many areas of emergency responses are concerned that there is laxity in preparedness for biological attacks because it is seen as a rarity. However, one participant noted the potential weaponization of not just the pathogens, but the wastes derived from patients infected with Ebola if they are not properly disposed to avoid secondary infectious. Some participants expressed the notion that the issue of bioterrorism is alien to them but noted the need to prepare for it. P5, O4 said "I think one of the obstacles is the state not having enough classes or courses to keep members sufficiently educated on things that pop-up that is new. I think there is enough knowledge about Ebola from the last outbreak. But, like you said, if they are inventing Ebola-pox biological agent. I think the state has to

look at that and how do we protect EMTs and first responders who will be the first on the scene to treat these people. So, I think we really need to push the state for more courses, more awareness for EMTs, or classes."

Having more classes at regular intervals had a lot to do with funding. And the funds appear not there. For example, P1, O4, in response to question 9 echoed the sentiment of many participants: "I will say money. It will be the top obstacle there. Personnel dedicated to learning how to train people and implementing such training in organizations." One participant (P2, O1) particularly mentioned that the lack of resources was responsible for the many emergency organizations making extensive use of volunteers. The use of volunteers, he noted has its drawbacks because the volunteers do not have as much time as regular paid EMTs to train and acquire more knowledge.

Of the 18 participants, only four expressed a fair working knowledge of pathogens and how to handle them if they have to respond to bioterrorism. These assertations were in spite of the county's all Hazard Mitigation Plan of 2008 and the reviewed and revised version in 2015.

Politics Stream:

One thing was clear: EMTs were adequately knowledgeable and trained for most emergencies besides emergency responses that involve biological agents. But developing effective emergency response practices would build bioterrorism hardening among first responders.

Theme 4: Adequate planning and preparedness

Question 1: How would you describe the existing emergency response practices in your

organization?

Concerning Question 1, almost, every participant expressed better preparedness before and after the Ebola epidemic for general emergency responses. The contributing sources were training, prepared and standard response. Prepared and adequate were mentioned 35 times (the second highest occurrence: 8.73 percent), and standard response represented 3.74 percent (15 occurrences). They noted the increased preparedness for infectious diseases responses during and the immediate years after the 2014 epidemic. But the bioagent preparedness and awareness level have steadily declined because Ebola threat no longer existed. P2, O3 stated "We have learned a lot, especially after the Ebola outbreak. They have gotten us more prepared. Before we were dropping the ball. We are a lot prepared."

P2, O1 expressed a similar sentiment: "everyone had training and awareness was heightened at that time." This concern was a general trend among many participants. It is instructive that most of the participants expressed above average or adequate preparedness for emergency responses. But the responses changed when the question is on preparedness for biological attacks (Question 2), especially after the Ebola epidemic. P2, O2, informed that "…since they epidemic disappeared. There has been no refresher training. It has not been in the media. It has fallen by the wayside." P3, O1 spoke in the same vein for Q1: "We are adequate. I am a volunteer. We are pretty educated. We have to recertify every two years. We take classes. We have to have 24 hours of continuing education."

Further, P5, O1 echoed the sentiment of P3, O1 when he responded to Q1 this way: “Our current emergency response is in accordance with standard operating procedure (SOP). We are only trained at awareness level to know how to identify and stay safe until the appropriate personal gets there.” P1, O3, when asked to describe their preparation for an emergency response said, “it is above average.”

Theme 5: Mandatory bioterrorism training

Question 5: How do your emergency response protocols prepare you for potential bioagent or biological attacks?

Question 6: What kind of preparedness and training do you need for disaster response?

The participants, in general, called for more training in bioterrorism preparedness. Their suggestions allied with their responses in Questions 1 and 2 that while EMTs’ emergency response, practices, and knowledge were above average in most areas of emergency response, they were below average when it came to bioterrorism preparedness. The contributing sources for this theme were training, awareness of WMD (29 occurrences:7.23 percent), the safety of the responders (18 occurrences: 4.49 percent) and universal precaution (16 occurrences: 3.99 percent). The codes operating within the politics stream contributed to the theme, mandatory bioterrorism hardening and were useful in understanding bioterrorism preparedness.

Excerpts from the participant: On bioterrorism preparedness P4, O1 emphatically stated: “It does not prepare us at all.” In response to Question 5, P4, O2 unequivocally stated “Again, it all comes down to training and awareness preparedness.” Similarly, on Question 5, P2, O2 provided this response “And, we do need more Hazmat awareness

training. It is good to have Hazmat knowledge and the steps you can take to protect yourself and not just knowing that it is bad." Another participant added, "again, it goes back to our basic training. That our safety is first and foremost in our response." On Question 6, the participant responded, "again, a lot of it is mostly awareness recognition and reaction." P1, O2 spoke in the same vein when he stated, "You should have WMD awareness which I believe is now part of the basic EMT curriculum." And further added, "The main thing is to maintain good universal precautions." Another participant's response to Question 6 included this response, "we need a mandatory requirement of being trained at least, in the minimum, the CBRNE awareness, and operations every two years along with Hazmat awareness and operations."

Another participant, P2, O3, stated the urgency for "the standard training throughout the different agencies in the area. If we have one standardized training, police, fire EMS, they all go for the same training." P4, O3 when asked Question 6 stated "try to make people aware of what they may be going into, what kind of pathogens they may come upon, what steps they can take to prevent exposures as much as possible. Again, paramount is their safety first." Finally, P4, O1 concluded that "I think we do more preparation for mass casualty than we do for anything else per injury-wise." And that 'anything else' includes, lack of bioterrorism preparedness.

Policy Stream:

Participants noted that in addition to other emergency response practices, there is a need for increased interagency collaborations and enhanced safety measures when responding to emergencies. These measures would increase EMTs' willingness to

respond to emergencies including bioterrorism. However, achieving these measures would require political will among policymakers.

Theme 6: Collaboration Among Agencies

Question 7: What areas of training or tools do you think you will need for effective bioterrorism and emergency response?

Question 8: What other suggestion would you proffer for adequate bioterrorism and infectious disease response by emergency medical responders?

Some factors that participants suggested will help improve emergency responses are intra-and interagency collaboration and training. These are training among emergency organizations and training between EMSOs and other first responders such as the Police and the fire fighters. Other contributing sources for this theme include drills, PPE and information sharing among the agencies. Specifically, drills, PPE, and collaboration had a total of 53 sources which amounted to 15.22% of the occurrences. Excerpts from the participants illustrated this point. Participant 2, Organization 3 (P2, O3) noted that "we will need mass drills, with everybody involved, your police, your fire, your EMS, your port authority and mass transit police. Mass training (and) drills spread throughout, classroom education you know, throughout the different agencies the same throughout the state. So that everybody is on the same page." Similarly, P3, O4 responded to Question 7, "You need hazmat awareness which is required by the state, is also required to be refreshed every year. You also need training for a biological response; you definitely need PPE training on donning and duffing techniques and need to conduct drills to practice doing it." P2, O3 responded to Question 7 thus in part: "I guess training

and drills. If there are new things out there, it should be put together, even if it is a power point, whatever. It should be done throughout the multi-agency. Like it got to be the same throughout." P2, O1 gave almost similar responses to Questions 7 and 8. She stated "Clearly, training on bioterrorism. Emergency response, you have to practice. Practicing (that is drilling) is a big part of emergency response at least yearly to keep up with the certification" (Question 7) and to Question 8 added: "The suggestion I will proffer to handle bioterrorism disease responses would be basically training. And not just training once. But practicing and keeping everyone up to date with what to do and how to do it."

To Question 8, P1, O3 responded "there should be easy access to protective gear, to training, education that does not hamper the overall response of the agency because we cannot afford it. Definitely, more money to every aspect of the response will be helpful." P4, O3 was even more blunt, "for everybody to be on the same page and have one standard throughout the state. Whether you are a volunteer or paid, everybody meets the same requirement from one agency to the next. We all have to have the same standard. I know some agencies do not even fit-test for N-95 Mask for tuberculosis patients. Other agencies bluntly say if it is this kind of patient, we will call another squad." The responses from the participants demonstrated the importance of drills, PPE, training, and collaboration to enhance bioterrorism preparedness and practices.

Theme 7: Safety and Job Security

Question 10: What policy changes do you think can make your emergency response safer?

Safety was a common decimal among most responders either regarding preparedness to help a victim or a patient and in responding to disaster situations. The main contributing sources for this theme are training, education and information sharing. For instance, Participant 5, Organization 4 (P5, O4) in response to Question 10, was particular about the manner many EMTs respond to a disaster situation, often with minimal regards to safety on the road. He expressed concern that EMTs when responding to calls, drive to the areas without obeying traffic lights, "I think there could be policy changes. Based on something as simple as responding to a scene. There has been a lot of talk about ambulances speeding, running through red lights, not obeying stop signs." P1, 03, was also of the view that information is central to better emergency response and suggested policy changes in that area: "The big part is information. We respond to what information we are given. So, the better our information, the better it all works out." P2, O2 said the issue of job security could impact on both the response effectiveness and retention of experienced staff. He stated: "mandate policy changes that almost place EMTs at the same level as the National Guard for public safety. Training times should be used without any repercussion."

Almost all the participants suggested the need for policy changes in the area of continuing training and education for the safety of the EMTs and their families in the event of a biological attack. The training will help them to recognize pathogens. P4, O3 stated that "not all of them have the same level of equipment. Not all of them meet the same mandate. Everybody needs to have the same type of training." He noted the danger of EMTs' not recognizing pathogens and not being cautious and end up taking the disease to

their families. He added "But it should recognize that this a very contagious disease. Let me start by contacting the hospital. I have already been home with my family twice. That is horrible. We should be able to recognize them." P5, O1, response to question 10: "there needs to be a mandatory level of training in this area as well as many. But this area is specific. We do online classes for chemical or what we call CBRNE training. But, I think it needs to go another step further on it and have just more scenario-based training in person." P4, O1 similarly responded to the same question this way, "It goes back to training and communication between the various health departments as far as, the trickle-down effect of getting out information down to the people faster." He added: "in fact, not just us. It has to involve the fire department, police department, health departments. Everybody has to be coordinated. That is, dissemination of information." And P2, O2 in response stated, "Grants for training to obtain classes perhaps policies particularly for volunteers; policies that allow employees to allow EMTs especially for volunteers to attend 2 week or 2 years degree program classes and still keep their jobs. Mandate policy changes that almost place EMTs at the same level as the National Guard for public safety. Training times should be used without any repercussion. It should be a policy."

Summary

One thing most of the participants stated was that before the 2001 anthrax attacks, there was next to zero knowledge of pathogens as potential weapons for biological attacks. That changed after the anthrax attacks. But they also added that few years following the anthrax attacks, training, and preparedness for biological attacks were regularly done. But the training declined years later until the 2014 Ebola epidemic. The

trend regarding gradual decline for bioterrorism preparedness also manifested and the trend continued in the immediate years after the 2014 Ebola epidemic.

This chapter discussed the emergency response preparedness and practices among EMTs, the factors that affected effective bioterrorism readiness and response. It also described the implications for inadequate preparedness for biological agents if weaponized. The research questions were designed to understand the current preparedness practices and discover ways to improve their emergency response, especially for bioterrorism. Consequently, seven themes emerged based on the outcome of the information gathered from the research participants. Two constant themes garnered from the data were the inadequate knowledge of biological agents and lack of resources (funds and human resources). The implications of lack knowledge and inadequate funding for bioterrorism preparedness would be increased vulnerability of EMTs, first responders and the public.

The other five themes were: Continuous education, Adequate planning and preparedness, Mandatory bioterrorism training, Collaboration among agencies, and Safety and job security. The participants' responses to the interview questions revealed insights into their emergency response practices and the dangers they confront when they respond to emergency calls. Also, the participants indicated the need to explore ways to improve and enhance EMTs' safety practices and preparedness policies, especially for bioterrorism.

In the next chapter, I discuss the research findings, identify the limitations of the study, make potential policy recommendations and conclude with the study's social change implications.

CHAPTER 5: CONCLUSION

Introduction:

The threat of bioterrorism was an issue that captured the attention of policymakers and the general public in the United States following the 2014 Ebola epidemic in West Africa and its manifestation in the United States. The apparent unpreparedness for such infectious diseases in the United States was seen in the uncoordinated responses from the healthcare community and the various levels of government which further created hysteria in the population (Olliaro et al., 2015). This study sought to understand the bioterrorism preparedness and practices among EMTs who are among the front-line health-care providers in the event of emergencies and biological attacks (CDC, 2000). The study focused on EMTs within a particular county in New Jersey and their bioterrorism preparedness and practices to discover areas of improvement. Data were collected via audio recorder in a face-to-face interview and recorded. The research participants were asked open-ended questions. The study participants met the participation requirement that included a minimum age of 25 and active EMT status during the Ebola epidemic. The EMTs were selected from the EMSOs using the purposeful sampling technique.

The data collected were transcribed and coded. Accurate transcription of the data and member-checking of the transcribed data ensured the trustworthiness of the findings. Two of the study participants identified areas of corrections which were rectified. The process of member-checking helped the study in ensuring that the transcript accurately reflected the information participants provided during the interview (Houghton et al.,

2013). After the member-checking process, the data were analyzed and coded. The coded and analyzed data showed that the major issues militating against adequate bioterrorism preparedness included inadequate funding, lack of adequate knowledge of biological agents, and lack of continuous education and training among EMTs. Data analysis identified the following themes: planning and preparedness, lack of resources; inadequate knowledge & information; continuous education, mandatory bioterrorism hardening, collaboration among agencies and safety and job security. The themes aligned with the study's theoretical framework of multiple stream theory (MST) and helped answer the research questions. Next, I discuss the purpose and nature of the study, a summary of the findings, limitations of the study, interpretation of the study findings, study recommendations and the recommendations' implications for social change.

Purpose and Nature of the Study

The study examined bioterrorism preparedness among EMTs in a New Jersey county to understand the nature and level of their preparedness for cutaneous forms of biological agents such as Ebola and to understand the policy and political implications for lack of or inadequate bioterrorism preparedness. The study also sought to identify strategies for improving bioterrorism hardening among EMTs and community-wide bioterrorism readiness that is different from the current preparedness plans, policies or programs.

Summary of the Findings

Part of the goal of this study was to understand EMTs' knowledge and awareness level of biological agents. Despite the preparedness strategies in place before and after

the 2001 anthrax attacks, including the HMP of 2015, the study found inadequate bioterrorism preparedness practices among EMTs interviewed for the study. This unpreparedness was evident in the participants' insufficient knowledge and awareness of most infectious diseases, including Ebola. On the other hand, the study found that EMTs were more prepared for other emergency medical situations than for bioterrorism or infectious disease epidemic. Despite the above findings, the study demonstrated that the 2014 Ebola epidemic created the awareness and urgency for bioterrorism preparedness practices especially in the immediate years after 2014. However, as the study also revealed, the heightened awareness of the potential use of bioagents for terrorism and the increased bioterrorism preparedness level were not sustained in the subsequent years after the Ebola epidemic. Conversely, the study found that despite the inadequate knowledge of bioagents and lack of continuous education for bioterrorism preparedness among EMTs, there was heightened safety precaution among the EMTs. As a result, EMTs, as a rule, applied more stringently the universal precautions, which emphasized personal protection to avoid contact with blood, bodily fluid or other potentially infectious materials when responding to emergencies (USDOL-OSHA, n.d.).

Finally, the study showed that interagency collaborations, constant drills (training), and biological agents' knowledge were critical to bioterrorism hardening but were hampered by inadequate funding. And, some of the emergency agencies were funded by private donations which often were not adequate and regular. Of the 18 study participants, 12 participants in response to Questions 2, 3, 4, 7, 8, 9, and 10 mentioned interagency collaboration in the areas of joint drills, information sharing and interagency

coordination as critical to bioterrorism hardening. All the 18 participants mentioned regular training in all the interview questions as the most critical element in bioterrorism hardening. The four codes (regular training, interagency collaborations, constant drills, and insufficient knowledge) out of the 14 codes represented 41.39% of the occurrences (198) of the codes. These aligned with the problem and policy streams of the MST that affirms the emergence of policies from problematic situations with the influence of the politics stream.

Some of the findings were consistent with some suggestions and scenarios found in the literature whether for emergencies or bioterrorism: that regular training and continuous knowledge acquisition of bioagents were critical to HCWs' readiness, effectiveness, confidence to work, and avoidance of secondary infections (Aghaei and Nesami, 2013; Kabir et al., 2016; MacIntyre, 2015; Taschner et al. 2016).

Interpretation of the Findings

In this section, I interpreted the study findings based on the themes that emerged and their relationship to the research questions and the theoretical framework of MST. The common denominators among the EMTs were the need for continuous education to acquire and update knowledge and hands-on training (drills) similar to tabletop scenarios that mimic real-life situations for bioterrorism hardening (Aghaei & Nesami, 2013). The findings confirmed the influence of clear actions towards bioterrorism preparedness necessary for bioterrorism hardening. The study findings affirmed the main tenet of MST that windows of opportunity are necessary for the emergence of new solutions to a problem. The findings also confirmed previous studies that preparedness is critical to

mitigating the effecting of bioterrorism and avoiding secondary infections among emergency workers (Eddy & Sase, 2015). But these studies were not specific to cutaneous pathogens and did not focus on EMTs. Bioterrorism preparedness actions included continuous education, training and drills (Kabir et al., 2016; Olson et al., 2014; Waldrop et al., 2014). This study added to knowledge because it was a post-Ebola study that recognized the missed opportunity of using the Ebola epidemic to assess EMTs and HCWs' preparedness for HIDs and bioagents (Taylor, 2015).

The research questions used for data collection were: Are EMSOs and EMTs in New Jersey prepared for a cutaneous form of biological attack such as EVD? What are the policy and political implications of lack of preparedness? The overwhelming revelations that emerged from the research interviews were that a majority of the EMTs were not prepared for bioterrorism attacks. The unpreparedness for bioterrorism was evident despite the all-Hazard Mitigation Plan (HMP) and the vulnerability of New Jersey to HIDs due to its geographic and demographic characteristics (ECOEM, 2018). The study also found that although regular drills and bioagents knowledge were needed the county and communities lacked the funds to execute them. For instance, of the 18 study participants, only two demonstrated adequate knowledge of biological agents which they attributed to training. Another two participants demonstrated fair knowledge of biological agents. The two participants with adequate knowledge of biological agents stated that they took courses and training in bioagents identification and response following the 2001 anthrax attacks.

The data and revelations from the study aligned with the two broad aspects of the research question and the theoretical framework of MST as demonstrated by the four broad categories identified in chapter 4. The categories identified were understanding emergency practices, impediments to bioterrorism preparedness, understanding bioterrorism Preparedness, and enhancing bioterrorism preparedness and practices. The themes that emerged also aligned with what the research questions set out to find: To understand the bioterrorism readiness of EMTs in New Jersey and the policy implications of lack of preparedness. The themes that emerged were discussed below in their order of occurrences and categorizations.

Category 1: Understanding Emergency Practices

Theme 4: Planning and Preparedness

The study intended to examine and understand the bioterrorism readiness of EMTs. However, the first interview question was about EMTs preparedness for general emergencies not necessarily specific to bioterrorism. A majority of the EMTs interviewed (16) indicated adequate preparedness for emergencies but not for bioterrorism in response to interview Question 1: How would you describe the existing emergency response practices in your organization? The remaining two participants stated that they were adequately prepared for both bioterrorism and general emergencies responses. The theme emerged following the EMTs' responses to the question, their respective years of experience responding to emergencies and the steps taking by their respective management teams to equip them as a result of the all-Hazard Mitigation Plans (HMP). Part of the goal of the HMP was to create "a more sustainable-resistant community."

(ECOEM, 2015) They used words such as trained, prepared, an adequate and standard response to describe their preparedness for medical emergencies but not for bioterrorism preparedness. The collateral consequence of preparedness for a medical emergency is the willingness to respond to all-hazard emergencies as the study by Barnett et al. (2012) found with little or no hesitation. This finding also supported an earlier study that established the relationship between preparedness (training, education, and practices) and emergency responses (Waldrop et al., 2014).

This finding is equally significant because it partially agreed with the current literature including Cinturati, 2014; Gursky & Bice, 2013; Lall et al., 2017 and Stratton, 2014) about preparedness among some HCWs for all forms of terrorism preparedness including bioterrorism but not within the EMTs population of HCWs. In the literature, preparedness or public health emergency preparedness and response (PHEPR) presupposed getting ready for the unknown happening, preventing the occurrence of emergency situations, and planning to respond appropriately to mitigate the effect of the emergency (Hedman, Knutsson, Ansell, Radstrom, & Rasmusson, 2013; Washington State Department of Health, 2016). All the study participants expressed their emergencies response readiness as NIMS outlined: mitigation, preparedness, response, and recovery. This preparedness readiness was lacking when it came to bioterrorism among EMTs principally because of their lack of adequate knowledge of biological agents. And, the lack of knowledge was a consequence of inadequate training occasioned by insufficient funding of EMSOs.

All the 18 participants stated adequate preparedness for their everyday emergency responses. But when asked about bioterrorism preparedness, 14 study participants expressed inadequacy, two participants stated little knowledge and two expressed adequate knowledge of biological agents. However, most study participants (16 out of the 18 participants) agreed that during and immediately after the Ebola epidemic there was a heightened awareness of the disease and readiness for potential epidemics as recommended by the CDC. But that awareness and readiness level declined as the years passed by. The decline in readiness and knowledge was due to the unavailability of funds to organize regular training, drills and continuous classroom-based education of EMTs. The collateral consequences of this decline in readiness have increased the vulnerability of EMTs, heightened the risk of secondary infections, and increased community-wide vulnerability bioterrorism and HIDs.

Preparedness for an emergency was linked to the frequency of responses to such emergencies unlike the rare responses to biological attacks or epidemics from bioagents such as the 2014 Ebola epidemic. Overall, from the perspective of the study participants, they were ready for emergencies such as medical, fire, natural disasters and accidents and that was affirmed by choice of words such as “prepared” and “adequately prepared” to describe their comfort level. Both codes were repeated 35 times representing 8.73% of the occurrences of the entire codes. Why did the awareness level and preparedness for bioterrorism decline in the years following the 2014 Ebola epidemic? The answer is found in the findings of the study. EMTs and EMOSs removed from the major cities believed that the threat no longer existed after the 2014 Ebola epidemic and that they

were remote targets for biological attacks. Although, on the face value, some of the cities where these EMSOs and EMTs operated may be unlikely targets, but their proximity to major cities such as the City of Newark made them vulnerable to potential biological attacks. There is, therefore, the need to adequately prepare against bioterrorism whether the EMTs are located in the major cities or the suburbs.

The problem of inadequate bioterrorism preparedness can be addressed by incorporating bioterrorism preparedness as part of regular emergency response readiness and recertification programs, and these suggestions correlate with kingdon's MS theory. The theory posits that in certain situations, to solve a problem, policymakers may advance urgent decisions from competing proposals to deal with a problem (Kingdon, 1984). In this instance, the 2014 Ebola epidemic revealed inadequate knowledge of bioagents by EMTs and inadequate preparedness for bioterrorism (problem stream). The data from the interview showed these problems could be addressed through any or a combination of the competing solutions or proposals including regular drills, adequate funding, continuous education and regular inter-agency training and collaboration (policy stream).

In the literature, it was clear that the lack of knowledge of bioagents was a problem that needed to be addressed for bioterrorism hardening among EMTs. It was also part of the problem that the 2008 and 2015 County HMPs intended to solve. The 2015 HMP is a hazard mitigation program that aligns with the politics stream as well. How EMTs understand and incorporate the strategies contained in the HMP will be critical to enhancing bioterrorism hardening. The convergence of these two streams (problem and

policy streams) opened up the window of opportunity for policymakers and administrators to advance proposals as political decisions (politics stream) to harden EMTs. The finding furthered knowledge because it demonstrated that the emergency response readiness could be replicated in bioterrorism situations if policymakers showed willingness and courage to make needed policy changes as the three streams converge through the window of opportunity.

Category 2: Impediments to Bioterrorism Preparedness

Passi et al. (2015) observed that part of the challenge in containing Ebola included lack of knowledge of the virus, institutional failings of the health system, and lack of experienced HCWs. These challenges were impediments to bioterrorism preparedness which the study findings largely collaborated. In addition, the findings showed that the impediments to bioterrorism preparedness also included the lack of adequate resources in the areas of funding and manpower development and inadequate information sharing. But participants were particularly concerned that there was poor funding for emergency responses as a whole and worse for bioterrorism preparedness which in some cases were non-existent. Poor funding leads to inadequate preparedness and increases the risk of secondary infections through the EMTs and first responders.

The challenge was also about allocating the available resources. And because some of the EMSOs see their organizations as remote targets, more resources were channeled to the more common emergency response issues such as medical emergency calls and fire hazards. The themes used by the participants to express their level of preparedness (inadequate funding, insufficient knowledge, and inadequate information

sharing) aligned with Kingdon's MST's problem stream. Kingdon's problem stream triggers the need for solutions which are consistent with the policy stream, and policymakers' decisions to advance urgent policies within the political stream to overturn the impediments because of pressures from interest groups and political expediency.

Theme 1: Lack of Resources

An underlying pattern that was clear across the EMSOs and EMTs was the idea that there should be regular training and adequate funding for bioterrorism preparedness not just for EMTs but for all first responders. I sensed the urgency among the participants for increased bioagent knowledge which would result in an increased willingness to respond to bioterrorism (Barnett et al., 2012). Increased willingness to response presupposes the ability to mitigate the impact of biological attacks and prevent or reduce the possibility of secondary infections (Ahmad et al., 2016). A major goal of this study was to understand the emergency response practices that involve biological agents. All the participants identified poor funding as a critical factor for the unpreparedness for all emergencies especially bioterrorism preparedness. The findings showed that whereas there were apparent lapses in bioterrorism preparedness, it was not for the reluctance of the EMTs to participate but due to inadequate funding for bioterrorism preparedness practices such as continuous education, periodic drills, and hands-on training. Inadequate funding as a major barrier for emergency response readiness was responsible for some of the cities' utilization of volunteers for emergency medical services. The volunteers work part-time, and in the evenings on the days they are available. Essentially, they provided skeletal emergency medical services.

And, the use of volunteers for emergence medical services has its peculiar problems that would require further study. For instance, using volunteers also had its shortcomings which included inadequate volunteers. Some cities lacked enough volunteers to cover the various shifts. The shortage of volunteer EMTs in some cities put enormous pressure on the neighboring towns with full-time EMTs as they tended to cover the neighboring cities with volunteer EMTs. Also, in some towns with volunteer EMTs, emergency offices are closed until evening when volunteer EMTs become available. Second, critical interagency cooperation is higher between agencies with full-time EMTs than between full-time agencies and volunteer agencies. This second problem is traceable to the partial availability of volunteer EMTs as noted earlier. Hence, the erosion of trust, confidence and effective collaboration. The above problems led to the third problem namely, non-retention of experienced EMTs. The higher than normal volunteer EMTs' turnovers as they relocate to other places in search of employment opportunities does not encourage the retention of experienced EMTs. As a result, the meager available resources are utilized in training new volunteers.

The importance of adequate funding for the execution of needed activities for bioterrorism preparedness such as continuous education, regular drills and the procurement of PPE has been documented (Maras & Miranda, 2016 & Waldrop et al., 2014). The lack of adequate funding was identified as responsible for the non-procurement of essential equipment such as the PPE for some agencies, and maintenance of existing equipment when due. The data from the interview showed that PPE was procured by emergency organizations following the Ebola epidemic, but no plans were

made for their maintenance or replacement. As the years went by, some of the equipment expired and needed replacement and others needed refurbishment, but there were inadequate funds to refurbish or replace them - inability to replace aging PPE because of inadequate funding was a critical issue in bioterrorism unpreparedness. Even if the funds were available, there was the added challenge of acquiring knowledge of bioagents and identifying their characteristics in emergencies. This is because each biological agent presents different symptoms and characteristics.

This problem of funding correlates with the problem stream of Kingdon's multiple stream theory. The inadequate funding showed the existence of a problem which in the MST's problem stream can appear after a disaster as was evident during and after the Ebola epidemic (Hayle, 2015). To overcome the funding problems, policymakers and emergency managers may pool resources and consolidate emergency services for efficiency and effectiveness especially among smaller towns whose meager resources were stretched thin during the Ebola epidemic. According to the Kingdon's model, policy makers and organizational managers can pursue a careful review of proposals that would address the problem issues which for the study are bioterrorism response plans.

Theme 2: Continuous Education

The EMTs in the towns where the interviews were conducted did not have regular and continuous education on bioterrorism preparedness despite the HMP of 2015. A major aim of the HMP 2015 was to ensure that HCWs in the county are adequately and continuously trained to effectively and efficiently respond to emergencies. Regularly updating EMTs' knowledge of biological agents is critical for effective emergency

responses to bioterrorism (Plough et al., 2013). The manner and urgency of emergency responses would not allow for laboratory testing of the disease before helping victims. The need for continuous education cannot be overstated. The importance of continuous education is encapsulated in continuous training to acquire and update knowledge and identify pathogens, and these ideas agree with the study by Aghaei and Nesami (2013). However, the problems of inadequate funding and lack of uniformity in staffing in some of the organizations were impediments to achieving the goal of increasing the knowledge base of HCWs including EMTs.

Although the problem of inadequate training was partly a result of inadequate funding, there is also the added problem of scheduling training especially in the organizations with volunteer EMTs. Volunteer EMTs have other jobs with different schedules and demands. As a result, the volunteer EMTs operated at different times based on their respective regular jobs, and that made it difficult to schedule training that required most of the EMTs at the same time. And, joint drills, training, and education in collaboration with other emergency organizations are needed to build interagency cooperation, collaboration, and coordination, for the synergy of ideas and comradery. To achieve policy changes regarding increased knowledge of HIDs through continuous education, policymakers must be ready to make the hard decisions as the politics stream of Kingdon's MST recommends.

Theme 3: Inadequate Knowledge and Information

As the data from the participants indicated, information sharing and knowledge of pathogen are critical elements in bioterrorism preparedness, and this finding supports the

existing literature (Passi et al., 2015). When asked about their knowledge of pathogens, only two of the 18 study participants expressed adequate knowledge of most HIDs. Lack of knowledge was identified as a major barrier to an effective emergency response involving infectious diseases. This finding was not surprising given that EMTs do not deal with pathogens on their daily emergency response activities. For example, except for four EMTs who were around during the 2001 anthrax attacks, the other EMTs interviewed would hardly recognize anthrax attacks if they occur now.

Information sharing and communication with both the public and other emergency agents are also critical to the effectiveness of EMTS. Information sharing with 911 callers who most often do not give adequate information to emergency dispatchers posed safety concerns to EMTs because they have inadequate information of what they are responding to. Despite the 2014 Ebola epidemic, the training and drills that followed and the policy recommendations contained in the 2015 HMP, there was still apparent inadequate knowledge of biological agents. This is because there has been no refresher training on bioterrorism preparedness for most EMTs even as new EMTs were either employed or have volunteered and that further increases the risk of secondary infections

When the question was asked about bioterrorism preparedness, 16 of the study participants expressed a poor level of preparedness because they lacked adequate knowledge of biological agents. For instance, insufficient knowledge of biological agents had 34 frequencies representing 8.48% of the occurrences of the codes. These responses aligned with a similar study in Nigeria by Oladimeji et al., 2015. Oladimeji et al., (2015)

found that most HCWs lacked adequate knowledge of biological agents and that demonstrated an existential problem in line with the problem stream of MST. When you add the lack of information (32 frequencies), the cumulative percentage of the frequencies for both codes represented almost one-sixth (16.46%) of the total occurrences.

The findings revealed that the impediments to bioterrorism preparedness practices were lack of funds, lack of continuous education and insufficient knowledge of biological agents and inadequate information sharing. These impediments to bioterrorism preparedness aligned with Kingdon's multiple stream theory that required the existence of certain conditions which policymakers and citizens must address for the desired policy and political changes to occur (Sabatier & Weible, 2014). The problems having been identified, it is then for policymakers to identify the most appropriate proposals or policy options to solve the problems. The 2014 Ebola epidemic and the attendant poor responses provided the windows of opportunity for bioterrorism hardening among EMTs. Interview questions that addressed this category and from which the themes emerged were Questions 2, 3, 4 and 9. The responses and findings aligned with earlier studies that utilized the MST and demonstrated that the existence of the window of opportunity was a prerequisite for the three streams to achieve desired goals (Brunner, 2008; Walhart, 2013). To overcome these barriers, improvements in funding, inter-governmental and inter-agency collaboration and better information sharing between the public and the EMTs through the emergency dispatchers are required. The window of opportunity is there for bioterrorism hardening among EMTs.

Category 3: Understanding Bioterrorism Preparedness

Critical to bioterrorism hardening is understanding what is required for bioterrorism readiness. This category formed the core of the study given the research question. Regardless of where one is located, any city, town, structure or school can be targeted. The study finding showed the lack of adequate knowledge of biological agents among EMTs has implications for their safety, the safety of their families and the community they serve. The overwhelming theme identified in this category was mandatory bioterrorism hardening when the study participants were asked about how best to achieve bioterrorism preparedness. Instituting preparedness practices that would bring about mandatory bioterrorism hardening will require political will from policymakers that Kingdon's multiple stream stresses.

Theme 5: Mandatory Bioterrorism Hardening

Over eighty percent of the study participants acknowledged the efforts of the various governments in the aftermath of the 2014 Ebola that increased the awareness level of infectious diseases such as Ebola among EMTs and the readiness strategies initiated to handle infected persons. Fifteen of the participants acknowledged the satisfactory initiatives to educate HCWs including EMTs about Ebola in the immediate years after the Ebola epidemic. The politics stream of MST helped explain this theme and the participant's data. The codes: training; awareness of WMD; universal precautions; and safety were derived from Interview Questions 5 and 6. The politics stream of Kingdon's MST and the findings were consistent with the literature which affirmed that

bioterrorism preparedness practices reduce the casualty rate among HCWs by about 75 percent in the event of bioterrorism (Jansen et al., 2014).

In line with the main elements of the MST, the 2014 Ebola epidemic provided the window of opportunity to address the issues of bioterrorism preparedness and hardening through the creation of awareness of WMD, strict application of the universal precautions, regular training, and safety of the responders (Abrol, 2016). The safety and protection of EMTs were assessed by how responders approach disaster situations with caution, don of PPE when attending to patients, and ask critical questions such as travel history (Decker et al., 2014). As a result of the Ebola epidemic and the lessons learned, EMTs became more stringent in asking leading questions such as: Did you travel outside the United States? Do you have a fever? Are you vomiting? This theme demonstrated that EMTs should, as a matter of urgency, be prepared to handle any disaster through more training, regular drills, continuous education, and inter-agency collaboration and information sharing for their safety and those of their communities. These are bioterrorism hardening practices. Unfortunately, these suggestions were in some agencies non-existent, and where existent, they were either not implemented, or their implementations were not sustained.

From this finding and the current literature, it was evident that the 2002 Bioterrorism Act, the 2004 NRF, 2006 Pandemic and all-Hazards Preparedness Act (PAHPA), the National Health Security Strategy of the United States of America (NHSS), PAHPRA of 2013 and the 2008 and 2015 all Hazard Mitigation Plans (HMPs) did not achieve the common objective of building community-wide resilience emergency

responses practices (DHS, 2016; Eddy & Sase, 2015; Shelton et al., 2012;). The problems in the past gave rise to proposals from which policies were created including the Bioterrorism Act of 2002 following the 2001 anthrax attacks. In 2014, the Ebola epidemic and the responses to it revealed new problems that required policy changes from many competing proposals. Incidentally, the 2015 HMP was in a review when the Ebola epidemic occurred. According to the MST, policymakers must advance decisions to address them. Part of the policies made was the designation of some facilities as acute healthcare facilities for medical treatments without putting EMTs, their families, and their immediate communities at further risks. This policy should be followed with regular education and drills across emergency response organizations for efficiency and effectiveness when responding to disaster areas especially if biological agents are involved.

Category 4: Enhancing Bioterrorism Preparedness and Practices

Theme 6: Collaboration Among Agencies

An integral goal of the all-Hazard Mitigation Plan (HMP) was to have a mutually beneficial document that would be used throughout the county and reduce duplication of emergency response or mitigation initiatives. This goal presupposes strategic joint training and sharing of knowledge. The HMP mission statement also included the goals of partnership and collaboration to reduce vulnerability. Other bioterrorism preparedness programs and policies also aimed to achieve similar objectives. However, these goals of partnership, joint drills, HazMat Awareness and Operation and interagency collaboration

among first responders within the county have not been fully achieved as the data from the study indicated.

Following the 2001 anthrax attacks, there was an increased need for inter-governmental collaborations (Gamboa-Maldonado et al., 2012). What also appeared to be lacking as the study data showed was effective interagency collaboration during the 2014 Ebola epidemic response. There was overwhelming concern about the insufficient interagency collaborations and sharing of knowledge and information among EMTs. Interagency collaboration is critical given that EMTs and other emergency responders are mostly at risk of secondary infections in the course of performing their duties. Therefore, the HMP needs to be revamped and implemented for effective interagency collaboration and joint drills in emergency responses. This process could start with creating uniformity in the staffing of EMSOs.

The study found that the differences in the staffing of the emergency organizations across the county were considered a problem in interagency collaboration. Some EMSOs were staffed by full-time EMTs while some others were staffed by volunteers or part-time EMTs. Some other agencies' staff was a combination of both full-time and volunteers. The lack of uniformity in the staffing of EMTs in the county was a hindrance in interagency collaboration and information sharing. One study participant told me that some full-time EMTs do not feel comfortable sharing information or collaborating with the agencies staffed by volunteers. Some emergency medical agencies staffed by volunteers were not available at certain times of the day. Of the agencies in which I conducted the study, two of the agencies were staffed by full-time EMTs; one

agency was staffed by volunteer EMTs, and the other agency was a mixture of both full-time and volunteer EMTs. Some of the volunteer EMTs themselves acknowledged that it was a problem especially in attending training, continuous education programs, and drills because the EMS activities often conflict with their regular jobs.

In spite of the problem of the low level of collaboration among EMSOs and EMTs, there is the urgent need to engage with other emergency response agencies, share information with first responders, train together and conduct joint drills. These collaborative initiatives are prerequisites for effective real-time joint responses to actual disaster situations by EMTs. Also, inter-agency coordination, cooperation, and collaboration reduce the cost of running EMSOs and increase the effectiveness and efficiency of emergency response practices. The need for effective inter-agency collaboration programs or policies as prerequisites for bioterrorism preparedness aligns with Kingdon's MST politics stream. Such a program would facilitate a careful review of the preparedness policies by policymakers to address the problems of lack of uniformity and effective collaboration. The policymakers in this instance will include the management of EMSOs who handle the day to day affairs of emergency response practices and policymakers. The study contributes to the existing body of knowledge on bioterrorism preparedness by highlighting the urgency for all-hazard inter-agency collaboration, cooperation, and coordination.

Theme 7: Safety and Job Security

Other issues that EMTs considered critical to an effective emergency response were safety and job security. These issues were of concern to ten of the EMTs

interviewed. The issues of safety and job security align with Kingdon's MST's politics stream. Politics stream of MST stresses the roles policymakers must play to address the issues within the problem stream from the competing solutions or proposals (Kingdon, 1984). Participants' answers to interview Questions 7, 8, and 10 provided policy choices that may be considered for the overall safety of both the emergency medical responders and the general population. The vulnerability of EMTs can be far-reaching and are not restricted by age or gender as the study findings showed with the distribution of the participants' age, gender, and educational status. The vulnerability of EMTs was recognized in the revised all-Hazard Mitigation Plan of 2015, given the geographic and demographic characteristics of the county in which the study was conducted.

If EMTs are well trained, have uniformity in staffing, and have adequate knowledge of bioagents they will have a multiplier effect of protecting EMTs and their families and ensuring a safe and protected community (Hunger, 2014; Taylor, 2015). For instance, one participant said that it is a huge problem if EMTs will have to wait for about 48 hours before knowing what diseases they may have been exposed to when "we would have been with our families the past 24 hours." Data revealed that although the study participants made use of the triage system when approaching a disaster scene, the inadequate and, sometimes the lack of knowledge of bioagents still made EMTs vulnerable to bioagents infection. As a precaution, there is a need for stricter application of the triage system and by extension ask certain routine but important questions when responding to disaster or emergencies. At the minimum, the benefit of this finding is that

EMTs will look for and identify physical signs of diseases such as chicken pox, smallpox, Ebola and anthrax when responding to disaster scenes.

Experience of the EMTs was an issue that revealed itself during data collection. As the study data showed, the average years of experience of the study participants were 14.63 years. The implication of this average age of the study participants is that many of the EMTs became EMTs after the 2001 anthrax attacks. So, the 2014 Ebola epidemic was to some of the study participants and other EMTs, their real-time experience with emergency medical preparedness and responses that involved biological agents.

Another issue that participants raised was emergency agencies proximity or distance from what they perceived as high threat cities. For instance, big cities like Newark, Jersey City and Elizabeth (all in New Jersey) are considered more vulnerable than the participating emergency organizations' cities. The high threat is particularly more so for Newark City. And not much attention was devoted to bioterrorism prevention and mitigation in the HMP despite the high-profile targets including Newark Liberty International Airport, Newark Penn Station and the New Jersey Port Authority located in Newark and Elizabeth.

All four organizations involved in the study participated in the 2015 HMP review. And, the HMP also sort to make frontline-responders including EMTs safe by updating the strategies to mitigate risks and vulnerabilities including "natural and human-caused hazards in order to protect the health, safety, …, and all communities" in the county. Yet, EMTs are vulnerable to and ill-prepared for biological attacks.

In spite of the participating cities' less vulnerability to biological attacks, bioterrorism preparedness practices should be considered critical because any group of EMTs could be called upon to assist in disaster-hit cities or when biological agents are weaponized. This is because of their proximity to the high threat cities. The participating four organizations are within 10 miles of Newark City. And the City of Newark is considered the most vulnerable city in New Jersey, and these organizations may be called upon to help out if Newark is attacked with biological agents. The City of Elizabeth is about 15 miles from the cities involved in this study and about 21 miles from the City of Jersey City. It was, therefore, imperative that EMTs in as many cities as possible have bioterrorism hardening strategies namely, training, education and regular drills for the safety of the participants.

Another concern to EMTs was jobs security. A great number of EMTs are not career positions. Data showed that standardized training and uniformity in emergency response is critical to emergency response (Taylor, 2015). Data gathered during the study showed that various EMTs had different levels of education. There is a need to mandate uniformity in hiring and a standardized higher-level of educational qualification. Responses from five of the participants pointed to at least an associate (two-year) degree as the minimum educational level for EMTs. This policy should bring about a stronger professional bond among EMTs across cities. The themes of safety and job security emanated from the Interview Questions of 7, 8 and 10 and they coincide with the politics stream of Kingdon's MST which emphasizes policy formulation from the many competing solutions to deal with a problem (Kingdon, 1984). The formulation of job

security and safety policies are within the control of EMSOs, emergency response managers and government officials who make laws and policies. They constitute the policy-making body within the Kingdon's multiple streams, and they must incorporate policies or proposals that will guarantee the safety of EMTs and increase the retention of EMTs and, therefore, enhance bioterrorism hardening.

Limitations of the Study

The first limitation of the study was that none of the EMSOs and EMTs involved in the study was located in any of the three largest cities in New Jersey namely, Newark, Jersey City, and Camden. Efforts to involve some of them in Newark failed due to time constraint despite repeated requests. This limitation implies that the data from the study participants did not emanate from the EMTs whose cities are most likely to be attacked.

The second limitation is the unwillingness of the participants to share certain information that would have helped the study gain a better understanding of the critical elements involved in their current response strategies and how they may contribute to future bioterrorism preparedness and hardening. Aside from the prepared interview questions, I asked for existing bioterrorism preparedness strategies in each of the emergency organizations, if any. Most of the organizations refused to divulge such information. They stated they were not allowed to share such information with the public as precautionary measures. Also, they would not reveal the nature of their funding. Only one agency volunteered the information that all of its funding comes from donations from members of the community. That agency is made up of volunteer EMTs, and the community funds the agency's activities.

The third limitation was the underrepresentation of female EMTs and other racial groups such as the African Americans and Hispanic EMTs. This limitation had to do with the organizations that agreed to participate in the study. Efforts were made to ensure broader representation from EMTs in areas with a higher mixture of races, but the emergency agencies in those areas did not show interest to participate in the study. However, the under-representation of female EMTs in the agencies interviewed was because of the low number of female EMTs relative to their male counterparts and a reflection of the nature of the diversity of the EMTs in the participating organizations.

Recommendations for Future Study

This qualitative case study aimed to understand the nature of bioterrorism preparedness among EMTs in New Jersey. The study, therefore, focused on weaponized biological agents to the exclusion of other forms of terrorism: explosives, radiological, chemical and nuclear. While the study focused on biological agents, it was not clear how prepared EMTs are for these other potential forms of terrorism. The study recommends future studies is conducted on the readiness of EMTs for weaponized WMD: chemical, radiological and nuclear. In this age of the proliferation of weapons of mass destruction (WMD), any of them can be weaponized and first responders and HCWs should be prepared to respond to them.

Furthermore, I recommend that future study is conducted on the readiness of EMTs in the larger cities for a clearer understanding of their bioterrorism response readiness given that terrorists appear to target densely populated areas and cities. Previous studies showed that terrorists target areas with a high population for cause

societal disruption, panic and maximum human casualties (Jensen et. al., 2014; Green, LeDuc, Cohen, & Franz, 2019). The current study's inability to involve EMTs and EMSOs in the large cities was a limitation.

Some of the study participants during the interview noted the educational disparity among the EMTs. There was concern about the low educational requirements for becoming EMTs. Further study is recommended on the impact of higher education on the effectiveness of EMTs and how widespread this concern is among EMTs.

As the data from the interview revealed, collaborations should not only be among EMTs across cities but also among all first responders: EMTs, AEMTs, the firefighters, the police, MICNs, and the paramedics. The first responders have often jointly responded in disaster situations. Joint responses by first responders have the potentials to increase the risk of secondary infections if there are no joint preparedness programs. Therefore, there should be periodic collaborative training and joint drills so that everyone knows what do at any given time and stage of the response without increasing the risk of secondary infections. The themes that resulted from the data analysis will help in the bioterrorism hardening of all first responders and other healthcare practitioners. Therefore, I recommend for future studies on the readiness and preparedness of the other first responders for bioterrorism and weaponized WMD.

Implications for Change

The positive social change inherent in this study is in bringing about attitudinal change. The findings will create awareness among EMTs to always take precautionary steps when responding to emergencies especially in this age of the proliferation of

biological agents and other weapons of mass destruction (WMD). As the interview progressed, EMTs became more aware that recognizing the symptoms of biological agents was a prerequisite for bioterrorism hardening. The knowledge will galvanize EMTs and healthcare workers to agitate for more training, drills and regular education which are necessary for building community resilience to biological agents (Plough et al., 2013).

Second, the study findings will create awareness and urgency for collaborative initiatives, coordination, and cooperation among EMTs and between emergency agencies, and public awareness of bioagents. The threat posed by terrorists for potential weaponization of biological agents necessitated the need to share information, knowledge, and ideas, maximize scarce funds, and engage in joint training and drills for bioterrorism hardening.

Third, the study will bring about and encourage the mass education of citizens on the symptoms and effects of bioagents and how to control the spread. When citizens become knowledgeable of bioagents and the several symptoms, they will be able to communicate with 911 dispatchers and relay effectively what is happening and what symptoms they are experiencing. The collateral consequence and benefits are that EMTs will be better prepared to respond to such emergencies because of better knowledge of the emergency or disaster. The increased knowledge of bioagents among EMTs and the public will also make for community-wide safety and security and prevent or reduce secondary infections, contamination, and risk. This recommendation aligns with the recommendations of the HMP to prepare citizens and agencies for effective disaster

responses. But in this regards, greater efforts should be placed on preparing citizens and emergency responders for an effective and efficient bioterrorism response preparedness.

Throughout data collection, it was apparent that the EMTs interviewed lacked clear bioterrorism preparedness training and drills because the participants operated in smaller cities. Some EMTs alluded to that and remarked that they were less likely to be attacked. The study revealed the need to make EMTs in the smaller cities as prepared for bioterrorism as EMTs in the larger cities. EMTs in smaller cities have often been called upon to help neighboring larger cities during severe emergency situations. Therefore, they also need to acquaint themselves of bioagents that could be weaponized. The increased knowledge would equip EMTs with the knowledge base to make critical decisions within the limited time they have to attend to patients and avoid secondary infection of themselves and their colleagues (Ahmad et al., 2016).

Though the participants did not allude to it, it may be necessary for smaller cities to pull resources and merge their emergency response services to maximize resources and emergency response practices and readiness. Small cities do not have adequate resources to fund full-time emergency organizations. This study recommends that towns merge services to help maximize resources. The merging of emergency responses between or among cities can also be done between bigger towns and smaller cities.

Finally, improvements in the bioterrorism preparedness and practices have practical implications for positive social change through policy formulation and policy changes. Policy changes in the area of increased funding would help enhance community-level bioterrorism preparedness programs that cater to unique local needs and

increase interagency collaboration in the county. The collateral benefit of a community-wide bioterrorism preparedness program or policy is the hardening of not only EMTs but the entire first responders which include: EMTs, AEMTs, Fire Fighters, the Police, mobile intensive care nurses (MICNs) and the paramedics. As a result, all New Jersey regional emergency management plans such as the selected county's HMP need to be reviewed given the lessons learned from the responses to the 2014 Ebola epidemic and the data from the study.

Conclusion

I embarked on this qualitative research study to understand the bioterrorism readiness of EMTs in New Jersey. These non-hospital-based EMS organizations were purposefully chosen because of their proximity to the general population. Non-hospital-based EMS organizations are more likely to respond quicker than hospital-based EMTs because of their closeness to the general population. The study was also conducted to understand the policy implications for lack of bioterrorism hardening which can be measured in terms of bioterrorism preparedness programs and knowledge of biological agents. The study's 18 participants discussed their knowledge of biological agents that was less than adequate before the 2014 Ebola epidemic and in some cases non-existent. Preparedness and disease management should not only be for HCWs and those exposed to the disease but should also include those who fear that they have been exposed to the bioagent or the "worried well" and not just the exposed (Evans & Lawrence, 2006). A large number of the worried well put enormous pressure on the EMTs and the entire HCWs and affect their effectiveness.

The study participants' responses addressed the research questions that led to the emergence of seven major themes from 14 codes based on 401 total occurrences of the codes. The study found that the participants' bioagent knowledge and awareness increased during the Ebola epidemic and the immediate years after the epidemic. However, the increased knowledge and awareness level were not sustained because of the lack of continuous training as the years went by. Nevertheless, the participants recognized that preparedness programs and practices such as training, regular joint drills, continuous education, and interagency collaboration were essential to bioterrorism hardening. Conversely, the study identified the lack of adequate funding as the major barrier to the building of intra and interagency bioterrorism hardening among EMTs and implementing bioterrorism preparedness programs.

The threat of bioterrorism is real because terrorist groups are exploring ways to inflict maximum casualty, which is one of their main objectives (Green et al., 2019) There are various biological agents that terrorists and terrorist organizations can use to cause maximum damage and harm. These bioagents include Ebola, anthrax, and smallpox among others that the CDC identified and categorized based on their degrees of potency. The need to develop bioterrorism hardening strategies and programs has been urgent before and following the 2001 anthrax attacks. As a result, it was believed that the United States governments and the healthcare community were prepared for biological attacks. But the uncoordinated responses to the 2014 Ebola epidemic revealed inadequate preparedness and practices within the healthcare community for biological attacks despite the programs and policies put in place after the 2001 anthrax attacks and, therefore, a

policy failure on bioterrorism preparedness. And policy failure occurs when it fails to achieve the desired goals in certain aspects of the policy objectives (McConnell, 2016). There is, therefore, the urgent need to consider other approaches to bioterrorism preparedness and hardening.

However, the Ebola epidemic helped in creating awareness both within the medical community and among the general population. With the epidemic came the public knowledge of such terminologies as personal protection equipment (PPE), gasmasks, hazmat suits and donning and duffing. As the interview showed, there were deliberate attempts by the members of the medical community to maintain a high level of preparedness for infectious diseases and biological agents in the immediate years following the Ebola epidemic. However, as the years went by, many medical organizations and medical professionals including EMTs let down their guards. Thus, making them less prepared and more vulnerable should bioterrorism occur. The major factors responsible for this was the lack of funding and the feeling of less vulnerability among the EMTs in the organizations I conducted the study. The EMTs I interviewed attributed their feeling of less vulnerability to their "remote" locations. Other factors responsible for this lack of preparedness among EMTs include lack of training and lack of interagency collaborations. The study participants were either full-time, part-time or volunteers and the lack of uniformity in the constitution of EMTs were identified as one factor among others responsible for the lack of effective inter-agency collaboration.

The study findings have implications for social change because it will aid in policy formulation for bioterrorism hardening among EMTs and other emergency

medical responders through the procurement and servicing of preparedness equipment and allocation of adequate funding. The study findings will also help sensitize both the medical community and the general population in identifying bioagents and, therefore, help prevent and mitigate secondary infections, which are critical to bioterrorism hardening. The public knowledge and awareness will also bring about better information sharing among the public, emergency dispatchers and the EMTs and other first responders for better emergency response practices.

References

Abatemarto, A., Boklfv, I., Borjaii, M., Robson, M. (2007). Assessing and improving bioterrorism preparedness among first responders: A pilot study. *Journal of American Environmental Health, 69*(6), 16-22. Retrieved from http://www.neha.org

Abraham et al. (2012). Tabletop scenarios for realism in bioterrorism and threat preparedness. *West Virginia Medical Journal, 108*(6), 12-17. Retrieved from http://wvsma.org

Abrol, S. (2016). Countering bioterrorism threat to India: Employing global best practices and technology as force multiplier. *India Quarterly, 72*(2), 146-162. doi: 10.1177/0974928416637934

Ackrill, R., Kay, A., & Zahariadis, N. (2013). Ambiguity, multiple streams, and EU policy. *Journal of European Public Policy, 20*(6), 871 - 887, doi: 10.1080/13501763.2013.781824

Adalja, A. (2012). Anthrax: has the clinical milieu changed since 2001? *Journal of Community Hospital Internal Medicine Perspectives, 2*(2), 1-3. doi: 10.3402/jchimp.v2i2.18191

Aghaei, N. & Nesami, M. (2013). Bioterrorism education effect on knowledge and attitudes of nurses. *Journal of Emergencies, Trauma, and Shock, 6*(2), 78-82. doi: 10.4103/0974-2700.110747

Ahern, K. (2012). Informed consent: are researchers accurately representing risks and benefits? *Scandinavian Journal of Caring Sciences*, *26*, 671–678. doi:

10.1111/j.1471-6712.2012.00978. x

Ahmad, A., Khan, M., Jamshed, S., Kumar, B., Kumar, G., Reddy, P., & Ajmera, S. (2016). Are healthcare workers ready for Ebola? An assessment of their knowledge and attitude in a referral hospital in South India. *Journal of Infection in Developing Countries, 10*(7), 747 - 754. doi:10.3855/jidc.7578

Alcantara, C. & Roy, J. (2014). Reforming election dates in Canada: Towards an explanatory framework. *Canadian Public Administration, 57*(2), 256 – 274. doi: 10.1111/capa.12067

Allison, G., (2003). Implications for public policy of the threat from bioterrorism. Belfer Center for Science and International Affairs. Retrieved from http://www.belfercenter.org/research

Ananthula, D., Sama, R., Pamukuntla, D. & Adepu, S. (2012). Bioterrorism: An overview of agents, nature, consequences, detection and medical management. *Journal of Pharmaceutical and Scientific Innovation*, *1*(2), 35-43. Retrieved from http://www.jpsionline.com/

Anderson, P and Boker, G. (2012). Bioterrorism: pathogens as weapons. *Journal of Pharmacy Practice, 25*(5), 521-529. doi: 10.1177/0897190012456366

Antin, T., Constantine, N. & Hunt, G. (2015). Conflicting discourses in qualitative research: The search for divergent data within cases. *Field Methods, 27*(3) 211-222. doi: 10.1177/1525822X14549926

Aquino, L. & Wu, J. (2011). Cutaneous manifestations of Category A bioweapons. *American Academy of Dermatology, 65*(6). doi: 10.1016/j.jaad.2010.08.040

Arbon, P., Ranse, J., Cusack, L., Considine, J., Shaban, R., Woodman, R., Bahnisch, L., Kako, M., Hammad, K. & Mitchell, B. (2013). Australasian emergency nurses' willingness to attend work in a disaster: A survey. *Australasian Emergency Nursing Journal, 16*(2), 52-57. doi: 10.1016/j.aenj.2013.05.003

Avery, G. (2004). Bioterrorism, fear, and public health reform: Matching a policy solution to the wrong window. *Public Administration Review, 64*(3), 275-288. doi: 10.1111/j.1540-6210.2004.00372.x

Bakker, E. (2012). Forecasting terrorism: The need for a more systematic approach. *Journal of Strategic Security, 5*(4), 69-84. doi: 10.5038/1944-0472.5.4.5

Baize et al. (2014). Emergence of Zaire Ebola virus disease in Guinea. *The New England Journal of Medicine, 371*, 1418-1425. doi: 10.1056/NEJMoa1404505

Barakey, M. (2013). NIMS vs. agency command. *Fire Engineering, 166*(8), 91-94. http://www.fireengineering.com/index.html

Barnett, J., Levine, R., Thompson, C., Wijetunge, G., Oliver, A., … Balicer, R. (2010). Gauging U.S. emergency medical services workers' willingness to respond to pandemic influenza: Using a threat- and efficacy-based assessment framework. *PLoS ONE, 5*(3), 1-10. doi: 10.1371/journal.pone.0009856

Barnett, D., Thompson, C., Errett, N., Semon, N., Anderson, M., Ferrell, J. & Links, J. (2012). Determinants of emergency response willingness in the local public health workforce by jurisdictional and scenario patterns: A cross-sectional survey. *BMC Public Health, 12*(164), 1-11. doi: 10.1186/1471-2458-12-164

Barras, V. & Greub, G. (2014) History of biological warfare and bioterrorism. *Clinical*

Microbiology and Infection, 20(6), 497-502. doi: 10.1111/1469-0691.12706

Barratt, M. (2012). The efficacy of interviewing young drug users through online chat. *Drug and Alcohol Review, 31*(4), 566 - 572. doi: 10.1111/j.1465-3362.2011.00399.x

Barrow et al. (2015). High-throughput screening of a diversity collection using biodefense Category A and B priority pathogens. *Journal of Biomolecular Screening, 17*(7), 946 –956. doi:10.1177/1087057112448216

Baize et al. (2014). Emergence of Zaire Ebola Virus Disease in Guinea. *The New England Journal of Medicine, 371*, 1418-1425. doi:10.1056/NEJMoa1404505

Baxter, P., & Jack, S. (2008). Qualitative case study methodology: Study design and implementation for novice researchers. *The Qualitative Report, 13*(4), 544-559. Retrieved from http://nsuworks.nova.edu/tqr/

Becker, M. (2014). Explaining lone wolf target selection in the United States. *Studies in Conflict & Terrorism, 37*(11), 959-978. doi: 10.1080/1057610X.2014.952261

Berger, R. (2015). Now I see it, now I don't: Researcher's position and reflexivity in qualitative research. *Qualitative Research, 15*(2), 219 - 234. doi: 10.1177/1468794112468475

Berger, S. & Moreno, J. (2010). Public trust, public health, and public safety: A progressive response to bioterrorism. *Harvard Law Review, 4*(2), 295-317. Retrieved from http://harvardlpr.com

Birt, L., Scott, S., Cavers, D., Campbell, C., & Walter, F. (2016). Member-checking. *Qualitative Health Research, 26*(13), 1802-1811. doi:

10.1177/1049732316654870

Bitlauer, B. P. (2017). Weapons of mass hysteria, faulty biothreat predictions, and their impact on national (in)security: A case-study of smallpox or the misuse of mathematical modeling to project biothreats, terrorism attacks, and epidemics. *Health Matrix: Journal of Law-Medicine*, 27, 347–415. Retrieved from https://scholarlycommons.law.case.edu

Boscarino, J. & Adams, R. (2015). Assessing Community Reactions to Ebola Virus Disease and Other Disasters: Using Social Psychological Research to Enhance Public Health and Disaster Communications. *International Journal of Emergency Mental Health and Human Resilience, 17*(1): 234 - 238. doi:10.4172/1522-4821.1000147

Bouzianas, D. (2009). Medical countermeasures to protect humans from anthrax bioterrorism. *Trends in Microbiology, 17*(11), 522-528. Retrieved from doi: 10.1016/j.tim.2009.08.006

Brooks, R. (2011). Muslim "Homegrown" terrorism in the United States: How serious is the threat? *International Security, 36*(2), 7-47. Retrieved from http://muse.jhu.edu

Brown, G., Strickland-Munro, J., Kobryn, H. and Moore, S. (2017). Mixed methods participatory GIS: An evaluation of the validity of qualitative and quantitative mapping methods. *Applied Geography, 79*, 153–166. doi: 10.1016/j.apgeog.2016.12.015

Brunner, S. (2008). Understanding policy change: Multiple streams and emissions trading in Germany. *Global Environmental Change, 18*(3), 501–507. doi:

10.1016/j.gloenvcha.2008.05.003

Bureau of Labor Statistics (2019). EMTs and paramedics. Retrieved from https://www.bls.gov/ooh/healthcare/emts-and-paramedics.htm#tab-4

Burnette, R., Hess, J., Kozlovac, J. & Richmond, J. (2013). *Defining biosecurity and related concepts in biosecurity: Understanding, Assessing, and Preventing the Threat* (Burnette, Ed.). John Wiley & Sons, Hoboken, NJ

Burmeister, E., & Aitken, L. M. (2012). Sample size: How many is enough? *Australian Critical Care*, *25*, 271-274. doi:10.1016/j.aucc.2012.07.002

Bush, L. & Perez, M. (2012). The Anthrax Attacks 10 Years Later. *Annals of Internal Medicine, 156*(1), 41-44. doi: 10.7326/0003-4819-155-12-201112200-00373

Cairney, P. & Jones, M. (2016). Kingdon's multiple streams approach: What is the empirical impact of this universal theory? *Policy Studies Journal, 44*(1), 37-58. doi: 10.1111/psj.12111

Canyon, D. (2009). An assessment of bioterrorism competencies among health practitioners in Australia. *Emerging Health Threats, 2*(7), 1-14. doi: 10.3134/ehtj.09.007

Caretta, M. (2015). Situated knowledge in cross-cultural, cross-language research: a collaborative reflexive analysis of researcher, assistant and participant subjectivities. *Qualitative Research, 15*(4), 489 – 505. doi: 10.1177/1468794114543404

Caro, A., Puro, V., Fusco, F., Capobianchi, M. & Ippolito. G. (2015). Hospital preparedness for knowledge-based response to Ebola and other emerging

infectious diseases: A continuous challenge. *European Journal of Internal Medicine, 26*(6), 454–455. doi: 10.1016/j.ejim.2015.04.012

Caro, A., Puro, V., Fusco, F., Capobianchi, M., Lenini, S., Lauria, F., … Ippolito. G. (2015). The added value of long-lasting preparedness for the management of a patient with Ebola. *The European Journal of Medical Science, 26*(6), 451-452. doi: 10.1016/j.ejim.2015.03.005

Casale, D. (2010) Approach to bioterrorism: EC Green Paper on bio-preparedness. In Cankaya, S. & Kibaroglu, M. (Eds.). *Bioterrorism: Threats and deterrents*. IOS Press. Washington, DC

Cenciarelli, O. et al. (2013). Bioweapons and bioterrorism: a review of history and biological agents. Defence S&T Technical Bulletin*, 6*(2), 111-129. Retrieved from www.stride.gov.my

Cenciarelli, O., Gabbarini, V., Pietropaoli, S., Malizia, A., Tamburrini, A., Ludovici, G. … Gaudio, P. (2015). Viral bioterrorism: Learning the lesson of Ebola Virus in West Africa 2013–2015. *Virus Research, 210*(2), 318–326. Retrieved from doi: 10.1016/j.virusres.2015.09.002

Centers for Disease Control and Prevention (2000). Biological and Chemical Terrorism: Strategic Plan for Preparedness and Response - Recommendations of the CDC Strategic Planning Workgroup. *Mobility and Mortality Weekly Report, 49*(4), 1-26. Retrieved from https://www.cdc.gov/mmwr/PDF/RR/RR4904.pdf

Centers for Disease Control and Prevention (2014). Guidance for Developing a Plan for Inter-Facility Transport of Persons Under Investigation or Confirmed Patients

with Ebola Virus Disease in the United States. Retrieved from https://www.cdc.gov/vhf/ebola/pdf/interfacility-transport.pdf

Centers for Disease Control and Prevention (2015). Interim Guidance for Emergency Medical Services (EMS) Systems and 9-1-1 Public Safety Answering Points (PSAPs) for Management of Patients Under Investigation (PUIs) for Ebola Virus Disease (EVD) in the United States. Retrieved from http://www.cdc.gov/vhf/ebola/healthcare-us/emergency-services/ems-systems.html

Centers for Disease Control and Prevention (2016a). 2014 West Africa Ebola Outbreak Communication Resources. Retrieved from https://www.cdc.gov/vhf/ebola/outbreaks/2014-west-africa/communication-resources/index.html

Centers for Disease Control and Prevention (2016b). Cases of Ebola Diagnosed in the United States. Retrieved from https://www.cdc.gov/vhf/ebola/outbreaks/2014-west-africa/united-states-imported-case.html

Centers for Disease Control and Prevention (2016c). Zoonotic diseases. Retrieved from https://www.cdc.gov/onehealth/basics/zoonotic-diseases.html

Centers for Disease Control and Prevention – Federal Select Agent Program (2014). Select Agents and Toxins List. Retrieved from https://www.selectagents.gov/SelectAgentsandToxinsList.html

Centers for Disease Control and Prevention – National Institute for Occupational Safety and Health (2008). Guidance on Emergency Responder Personal Protective

Equipment (PPE) for Response to CBRN Terrorism Incidents. Retrieved from https://www.cdc.gov/niosh

Chan, Z. C. Y., Fung, Y., & Chien, W. (2013). Bracketing in phenomenology: Only undertaken in the data collection and analysis process? *The Qualitative Report, 18*(30), 1-9. Retrieved from Retrieved from http://nsuworks.nova.edu/tqr

Chen, A. & Yu, T. (2016). Network based temporary facility location for the Emergency Medical Services considering the disaster induced demand and the transportation infrastructure in disaster response. *Transportation Research Part B: Methodological, 91*, 408-423. doi: 10.1016/j.trb.2016.06.004

Choi, W., Hong, K., Hong, E. & Lee, W. (2015). Progress of vaccine and drug development for Ebola preparedness. *Clinical & Experimental Vaccine Research, 4*(1), 11-16. doi: 10.7774/cevr.2015.4.1.11

Chopra, K., Conde-Green, A., Folstein, M., Knepp, E., Christy, M., & Singh, D. (2014). Bioterrorism: Preparing the plastic surgeon. *ePlasty: Open Access Journal of Plastic Surgery*, 486-497. Retrieved from http://www.eplasty.com

Cinturati, F. (2014). The bioterrorism act and water utilities protection: How to proceed from policy to practice. *Journal of Applied Security Research, 9*, 97–108. doi: 10.1080/19361610.2014.851575

Clancy, T. (2008). Risk perception and respiratory protection utilization in emergency medical technician population (Doctoral dissertation). Retrieved from ProQuest Dissertation Publishing. (3320283)

Cohen, M., March, J. & Olsen, J. (1972). A Garbage Can Model of Organizational

Choice. *Administrative Science Quarterly, 17*(1), 1-25. doi: 10.2307/2392088

Cole, L. (2012). Bioterrorism: Still a threat to the United States. *Combating Terrorism Center Sentinel*, 5(1). Retrieved from https://ctc.usma.edu

Collins, C. & Cooper, J. (2014). Emotional intelligence and the qualitative researcher. *International Journal of Qualitative Methods, 13*, 88-103. doi: 10.1177/160940691401300134

Coltart, C., Johnson, A. and Whitty, C. (2015). Role of healthcare workers in early epidemic spread of Ebola: policy implications of prophylactic compared to reactive vaccination policy in outbreak prevention and control. *BMC Medicine, 13*(271). doi: 10.1186/s12916-015-0477-2

Connelly, L. (2016). Understanding research: Trustworthiness in qualitative research. *MEDSURG Nursing, 25*(6), 435-436. Retrieved from www.medsurgnursing.net

Cope, D. (2014). Methods and Meanings: Credibility and Trustworthiness of Qualitative Research. *Oncology Nursing Forum, 41*(1), 89 - 91. doi: 10.1188/14.ONF.89-91

Cope, D. (2015). Methods and meaning: Conducting pilot and feasibility studies. *Oncology Nursing Forum, 42*(2), 196-197. doi: 10.1188/15.ONF.196-197.

Craig, A., Kasai, T., Li, A., Otsu, S. & Khut, Q. (2010). Getting back to basics during a public health emergency: A framework to prepare and respond to infectious disease public health emergencies. *Public Health, 124*(1), 10–13. Retrieved from doi: 10.1016/j.puhe.2009.11.011

Crane, J., McCluskey, J., Johnson, G. & Harbison, R. (2010). Assessment of community healthcare providers' ability and willingness to respond to emergencies resulting

from bioterrorist attacks. *Journal of Emergencies, Trauma & Shock, 13*(1), 13-20. doi: 10.4103/0974-2700.55808

Creswell, J. W. (2013). *Qualitative inquiry & research design: Choosing among five approaches*. SAGE Publications, Inc. Thousand Oaks, CA.

Creswell, J. (2014). *Research Design: Qualitative, quantitative, and mixed methods approach* (4th Ed.). SAGE Publications, Inc., Thousand Oaks, CA.

Creswell, J. (2015). 30 essential skills for the qualitative researcher. SAGE Publications, Inc. Los Angeles, CA

Das, S. & Kataria, V. (2010). Bioterrorism: A public health perspective. *Medical Journal Armed Forces India, 66*(3), 255-260. Retrieved from doi: 10.1016/S0377-1237(10)80051-6

Decker, B., Sevransky, J., Barrett, K., Davey, R., & Chertow, D. (2014). Preparing for critical care services to patients with Ebola. *Annals of Internal Medicine, 161*(11), 831-832. doi: 10.7326/M14-2141

Department of the Homeland Security (2014). Written testimony of OHA acting Assistant Secretary Dr. Kathy Brinsfield and S&T Under Secretary Dr. Reginald Brothers for a House Committee on Homeland Security, Subcommittee on Emergency Preparedness, Response, and Communications hearing titled "BioWatch: Lessons Learned and the Path Forward" Retrieved from https://www.dhs.gov/news/2014/06/10/written-testimony-oha-acting-assistant-secretary-and-st-under-secretary-house

Department of Homeland Security (2015). Presidential Policy Directive / PPD-8:

National Preparedness. Retrieved from https://www.dhs.gov/presidential-policy-directive-8-national-preparedness

Department of Homeland Security (2016). National Response Framework (3th ed.) Retrieved from https://www.fema.gov

Dikko, M. (2016). Establishing construct validity and reliability: Pilot testing of a qualitative interview for research in takaful (islamic insurance). *The Qualitative Report, 21*(3), 521-528. Retrieved from http://nsuworks.nova.edu/tqr

Dittmar, M. (2013). Sandy "toughest test" for New York and New Jersey responders. *Fire Engineering, 166*(5), 6-21. Retrieved from www.fireengineering.com

Dudley, J. & Woodford, M. (2002). Bioweapons, bioterrorism and biodiversity: potential impacts of biological weapons attacks on agricultural and biological diversity. *Scientific and Technical Review, 21*(1). doi: 10.1641/0006-3568(2002)052[0583:BBAEPE]2.0.CO;2

Duncan, W., Ginter, P., Rucks, A., Wingate, M. & McCormick, L. (2007). Organizing emergency preparedness within United States public health departments. *Journal of the Royal Institute of Public Health, 121*(4), 241-250. Retrieved from doi: 10.1016/j.puhe.2006.10.014

Eddy, C. & Sase, E. (2015). The 2014 Dallas, Texas, Ebola incident: Global implications to all-hazards preparedness and health care worker protection. *Journal of Environmental Health, 78*(2), 28-22. Retrieved from http://www.neha.org/

Edwards, S. (2017) Like a chameleon: A beginning teacher's journey to implement active learning. *RMLE Online, 40*(4), 1-11. doi:10.1080/19404476.2017.1293599

Edwards, D., Price, P., Gordon, S., Gadgil, A. (2005). Guidelines to improve airport preparedness against chemical and biological terrorism (unlimited release version). Sandia National Laboratories. Retrieved from http://www.sandia.gov

Elbe, S., Roemer-Mahler, A., & Long, C. (2014). Securing circulation pharmaceutically: Antiviral stockpiling and pandemic preparedness in the European Union. *Security Dialogue, 45*(5), 440-457. doi: 10.1177/0967010614530072

English, J., Cundiff, M., Malone, J., Pfeiffer, J., Bell, M., Steele, L. & Miller, M. (1999). Bioterrorism readiness plan: A template for healthcare facilities. Retrieved from https://emergency.cdc.gov

Eslamian, J., Moeini, M. & Soleimani, M. (2015). Challenges in nursing continuing education: A qualitative study. *Iranian Journal of Nursing & Midwifery Research, 20*(3), 378-386. Retrieved from https://www.ncbi.nlm.nih.gov/pmc

Evans, G. & Lawrence, S. (2006). Preparing for and responding to bioterrorist attacks: The role of disease management initiatives. *Disease Management & Health Outcomes, 14*(5), 265-274. doi: 10.2165/00115677-200614050-00002

Fasina, F., Adenubi, O., Ogundare, S., Shittu, A., Bwala, D. & Fasina, M. (2015). Descriptive analyses and risk of death due to Ebola virus disease, West Africa, 2014. *Journal of Infection in Developing Countries, 9*(12), 1298-1307. doi:10.3855/jidc.6484

Fernandez, A., Jonathan R. Studnek, J., Margolis, G., Crawford, J., Bentley, M., and Marcozzi, D. (2011). Disaster preparedness of nationally certified emergency medical services professionals. *Academic Emergency Medicine, 18*(4), 403–412.

doi: 10.1111/j .1553-2712.2011. 01030.x

Fidler, D. (2003). Public health and national security in the global age: Infectious diseases, bioterrorism, and realpolitik. Maurer School of Law: Indiana University. 787-856. Retrieved from http://www.repository.law.indiana.edu/

Finfgeld-Connett, D. (2014a). Intimate partner abuse among older women: Qualitative systematic review. *Clinical Nursing Research, 23*(6), 664-683. doi: 10.1177/1054773813500301

Finfgeld-Connett, D. (2014b). Use of content analysis to conduct knowledge-building and theory-generating qualitative systematic reviews. *Qualitative Research, 14*(3) 341 – 352. doi: 10.1177/1468794113481790

Foe, G. & Larson, E. (2016). Reading level and comprehension of research consent forms: An integrative review. *Journal of Empirical Research on Human Research Ethics, 11*(1), 31–46. doi: 10.1177/1556264616637483

Frankfort-Nachmias, C. & Nachmias, D. (2008). *Research methods in the social sciences* (7th Ed.). Worth Publishers, New York, NY

Frieden, T. & Damon, I. (2015). Ebola in West Africa - CDC's role in epidemic detection, control, and prevention. *Emerging Infectious Diseases, 21*(11), 1897-1905. doi: 10.3201/eid2111.150949

Fry-Pierce, C. & Lenze, P. (2011). Bioterrorism and U.S. domestic preparedness: Bureaucratic fragmentation and American vulnerability. *Journal of Homeland Security & Emergency Management, 8*(1). Article 39. doi: 10.2202/1547-7355.1887

Fusch, P., & Ness, L. (2015). Are we there yet? Data saturation in qualitative research. *The Qualitative Report, 20*(9), 1408-1416. Retrieved from http://nsuworks.nova.edu/tqr

Gaglio, B., Glasgow, R., & Bull, S. (2012). Do patient preferences for health information vary by health literacy or numeracy? A qualitative assessment. *Journal of Health Communication, 3*(17), 109 - 121. doi: 10.1080/10810730.2012.712616

Galada, H., Gurian, P. & Hong, T. (2013). First responder knowledge and training needs for bioterrorism. *Homeland Security & Emergency Management, 10*(2), 631–660. doi: 10.1515/jhsem-2012-0064

Gallo, A., Weijer, C., White, A., Grimshaw, J., Boruch, R., Brehaut, J., … Taljaard, M. (2012). What is the role and authority of gatekeepers in cluster randomized trials in health research? *Trials, 13*(116). doi: 10.1186/1745-6215-13-116

Gamboa-Maldonado, T., Marshak, H., Sinclair, R., Montgomery S, & Dyjack, D. (2012). Building capacity for community disaster preparedness: A call for collaboration between public environmental health and emergency preparedness and response programs. *Journal for Environmental Health, 75*(2): 24–29. Retrieved from https://www.ncbi.nlm.nih.gov/pmc

Ganguli, I., Chang, Y., Weissman, A., Armstrong, K. & Metlay, J. (2016). Ebola risk and preparedness: A national survey of internists. *Journal of General Internal Medicine, 31*(3), 276-281. doi: 10.1007/s11606-015-3493-1.

Garner, N., Baker, J. & Hagelgans, D. (2016). The private traumas of first responders. *Journal of Individual Psychology, 72*(3), 168-185. doi: 10.1353/jip.2016.0015

Gelling, L. (2015). Stages in the research process. *Nursing standard, 29*(27), 44-29. doi: 10.7748/ns.29.27.44.e8745

Gentles, S., Charles, C., Ploeg, J., & McKibbon, K. (2015). Sampling in qualitative research: Insights from an overview of the methods Literature. The qualitative report*, 20*(11), 1772-1789. Retrieved from http://nsuworks.nova.edu/tqr

Gerstein, D. (2017). Glaring gaps: America needs a biodefense upgrade. *Bulletin of the Atomic Scientists, 73*(2), 86-91. doi: 10.1080/00963402.2017.1288438

Gilmore, G., Schwan, W., & McLaughlin, M. (2007). An assessment of emergency preparedness in western Wisconsin. *Wisconsin Medical Journal, 106*(2), 71-77. Retrieved from https://www.wisconsinmedicalsociety.org/

Gire, S. et al. (2014). Genomic surveillance elucidates Ebola virus origin and transmission during the 2014 outbreak. *Science, 345*(6202), 1369-1372. doi: 10.1126/science.1259657

Gonsalves, G. and Staley, P. (2014). Panic, paranoia, and public health -- The AIDS epidemic's lessons for Ebola. *The New England Journal of Medicine, 371*(25), 2348-2349. doi: 10.1056/NEJMp1413425

Gostin, L., Waxman, H. & Foege, W. (2015). The president's national security agenda curtailing Ebola, safeguarding the future. *Journal of America Medical Association, 313*(1), 27-28. doi:10.1001/jama.2014.16572

Gottron, F. (2014). The Project BioShield Act: Issues for the 113th Congress. Congressional Research Service. Retrieved from https://fas.org

Gottron, F. & Shea, D. (2011). Federal efforts to address the threat of bioterrorism:

Selected issues and options for Congress. Congressional Research Service, 1-19. Retrieved from https://fas.org

Green, J. (2015). Somatic sensitivity and reflexivity as validity tools in qualitative research. *Research in Dance Education, 16*(1), 67-79. Retrieved from doi: 10.1080/14647893.2014.971234

Green, J., Darbyshire, P., Adams, A. & Jackson, D. (2016). It's agony for us as well: Neonatal nurses reflect on iatrogenic pain. *Nursing Ethics, 23*(2), 176–190. doi: 10.1177/0969733014558968.

Green, M., LeDuc, J., Cohen, D., & Franz, D. (2019). Confronting the threat of bioterrorism: Realities, challenges, and defensive strategies. *The Lancet Infectious Diseases*, 19(1), e2-e13. doi:http://dx.doi.org.ezp.waldenulibrary.org/10.1016/S1473-3099(18)30298-6

Greene, J & Yu, S. (2014). Modeling and measuring epistemic cognition: A qualitative re-investigation. *Contemporary Educational Psychology, 39*(1), 12-28. Retrieved from doi: 10.1016/j.cedpsych.2013.10.002

Greub, G.; Grobusch, M. (2014). Bioterrorism: Myth or reality. *Clinical Microbiology & Infection, 20*(6), 485-487. doi: 10.1111/1469-0691.12713.

Griffith, J., Blaney, D., Shadomy, S. & Lehman, M. et al. (2014). Investigation of inhalation anthrax case, United States. *Emerging Infectious Diseases, 20*(2), 280-283. Retrieved from doi: 10.3201/eid2002.130021.

Grinnell, M., Dixon, M., Patton, M., Fitter, D., Bilivogui, P., Johnson, C., Dotson, E., Diallo, B., Rodier, G. & Raghunathan, P. (2015). Ebola virus disease in health

care workers - Guinea, 2014. *Morbidity and Mortality Weekly Report, 64*(38), 1083-1087. Retrieved from https://www.cdc.gov/

Gruenewald, J., Allison-Gruenewald, K. & Klein, B. (2015). Assessing the attractiveness and vulnerability of eco-terrorism targets: A situational crime prevention approach. *Studies in Conflict & Terrorism, 38*(6), 433–455. doi: 10.1080/1057610X.2015.1009798

Grundmann, O. (2014). The current state of bioterrorist attack surveillance and preparedness in the US. *Risk Management Healthcare Policy, 7,* 177-187. doi: 10.2147/RMHP.S56047

Gunaratne, N. (2015). The Ebola virus and the threat of bioterrorism. *Fletcher Forum of World Affairs. 39* (1), 63-76. 14. Retrieved from http://www.fletcherforum.org/.

Gursky, E. & Bice, G. (2013). Special feature: A decade in biosecurity assessing a decade of public health preparedness: Progress on the precipice? *Romanian Journal of Infectious Diseases, 16*(3), 129-140. doi: 10.1089/bsp.2011.0085.

Habib, F., Etesam, I., Ghoddusifar, S., & Mohajeri, N. (2012). Correspondence analysis: A new method for analyzing qualitative data in architecture. *Nexus Network Journal, 14*(3), 517-538. doi: 10.1007/s00004-012-0129-1

Harris, M., Dadwal, V., Wu, A. & Syed, S. (2015). It takes threat of Ebola to see lessons from low income countries. *Globalization & Health, 11*(1), 1-3. doi: 10.1186/s12992-015-0102

Hasan, R. (2014). Biological weapons: Covert threats to global health security. *Asian Journal of Multidisciplinary Studies, 2*(9), 37-46. Retrieved from

http://ajms.co.in/

Hastings, J. & Chan, R. (2013) Target hardening and terrorist signaling: The case of aviation security, *Terrorism and Political Violence, 2*(5), 777-797. doi: 10.1080/09546553.2012.699906

Hayle, S. (2015). Comparing drug policy windows internationally: Drug consumption room policy making in Canada and England and Wales. *Contemporary Drug Problems, 42*(1), 20-37. doi: 10.1177/0091450915569724

Hayman, D. (2010). Lessons from the Fall 2001 anthrax attacks. In S. Cankaya, & M. Kibaroglu, (Eds.), *Bioterrorism: Threats and deterrents*. Washington, DC: IOS Press. doi: 10.3233/978-1-60750-501-3-79

Hedman, J., Knutsson, R., Ansell, R., Radstrom, P. & Rasmusson, B. (2013). Pre-PCR processing in bioterrorism preparedness: Improved diagnostic capabilities for laboratory response networks. *Biosecurity and Bioterrorism: Biodefense Strategy, Practice, and Science, 11*(1), 87-101. doi: 10.1089/bsp.2012.0090

Hegney, D. & Chan, T. (2010). Ethical challenges in the conduct of qualitative research (through 2013). *Nurse Researcher, 18*(1), 4-7. doi: 10.7748/nr2010.10.18.1.4.c8042

Henderson, D. (2014). John Bartlett and Bioterrorism. *Clinical Infectious Diseases*: An official publication of the infectious diseases. Society of America*, 59*(S2), 76-79. doi: 10.1093/cid/ciu393

Hennink, M., Kaiser, B. & Marconi, V. (2017). Code saturation versus meaning saturation: How many interviews are enough? *Qualitative Health Research,*

27(4), 591-608. doi: 10.1177/1049732316665344

Hodge, J. (2002). Bioterrorism law and policy: Critical choices in public health. *Journal of Law, Medicine and Ethics, 30*(2), 254-261. doi: 10.1111/j.1748-720X.2002.tb00391.x

Hoeijmakers, M., De Leeuw, E., kenis, P. & De Vries, N. (2007). Local health policy development processes in the Netherlands: An expanded toolbox for health promotion. *Health Promotion International, 22*(2), 112-121. doi:10.1093/heapro/dam009

Hoeppner, M., Olson, D. & Larson, S. (2010). A longitudinal study of the impact of an emergency preparedness curriculum. *Public Health Reports, 125*, 24-32. doi: 10.1177/00333549101250S505.

Houghton, C., Casey, D., Shaw, D., Murphy, K. (2013). Rigour in qualitative case-study research. *Nurse Researcher, 20*(4), 12-17. doi: 10.7748/nr2013.03.20.4.12.e326

House of Representatives Committee on Science (2004). Bioterrorism preparedness: Peoples, tools, and systems for detecting and responding to a bioterrorist attack. Series No. 4.SCI 2:108-56. Retrieved from https://babel.hathitrust.org/

Howlett, M., McConnell, A., & Perl, A. (2015). Streams and stages: Reconciling Kingdon and policy process theory. *Journal of Political Research*, 54,3, 419-434. doi: 10.1111/1475-6765.12064

Hughes, J. & Gerberding, J. (2002). Anthrax bioterrorism: Lessons learned and future directions. *Emerging Infectious Diseases, 8*(10), 1013-1014. doi: 1032 01/eid0810.020466

Hunger, I. (2014). Winning the battle against emerging pathogens: A German response. *Bulletin of the Atomic Scientists, 70*(4) 22–25. doi: 10.1177/0096340214539133

Hunter, J., Yang, J., Crawley, A., Biesiadecki, L. and Aragón, T. (2013). Public health response systems in-action: Learning from local health departments' experiences with acute and emergency incidents. *PLoS ONE, 8*(11), 1-13. doi: 10.1371/journal.pone.0079457

Hyett, N., Kenny, A., & Dickson-Swift, V. (2014). Methodology or method? A critical review of qualitative case study reports. *International Journal of Qualitative Studies on Health and Bell-Being, 9*, 1-12. doi:10.3402/qhw.v9.23606

Jacob, S. & Furgerson, S. (2012). Writing interview protocols and conducting interviews: Tips for students new to the field of qualitative research. *The Qualitative Report, 17*(42), 1-10 Retrieved from http://www. nsuworks.nova.edu/tqr.

Jansen, H., Breeveld, F., Stijnis, C. & Grobusch, M. (2014). Biological warfare, bioterrorism, and biocrime. *Clinical Microbiology and Infections, 20*(6), 488 – 496. doi: 10.1111/1469-0691.12699

Jernigan, J. et al. (2001). Bioterrorism-related inhalational anthrax: The first 10 cases reported in the United States. *Emerging Infectious Disease Journal, 7(*6), 933–944. doi: 10.3201/eid0706.010604.

Johnson, B. (2013). Transnational terrorism: globalization, voluntary compliance, and U.S. port security. *Global Studies Journal, 5*(4), 65-76. Retrieved from www.http://gsj.cgpublisher.com

Kabir, B., Naik, D., Kumar, V, & Bhas, G. (2016). Awareness and knowledge about

bioterrorism among medical students at a University in Malaysia. *Malaysian Applied Biology, 45*(2): 63–67. Retrieved from http:// http://mabjournal.com/

Kadlec, B. (2013). The risk of bioterrorism and bio-warfare. Retrieved from http://www.nationalacademies.org/

Kar, S., Pradhan, H. & Pattnaik, B. (2012). Bioterrorism: How prepared are we? *Indian Journal of Medical Specialities, 3*(1), 43-48. doi: 10.7713/ijms.2012.0010

Katikireddi, S., Hilton, S., Bonell, C. & Bond, L. (2014). Understanding the development of minimum unit pricing of alcohol in Scotland: A qualitative study of the policy process. *PLoS ONE, 9*(3), 1-10. doi: 10.1371/journal.pone.0091185.

Katz, R., Attal-Juncqua, A., & Fischer, J. E. (2017). Funding public health emergency preparedness in the United States. *American Journal of Public Health*, 107, 148 – 152. doi: 10.2105/AJPH.2017.303956

Kelly, E. & Hassett-Walker, C. (2016). The training of New Jersey emergency service first responders in autism awareness. *Police Practice and Research, 17*(6), 543-554. doi: 10.1080/15614263.2015.1121390

Kenar, L. & Baysallar, M. (2010) Types of biological agents and medical counterterrorism against bioterrorist attacks. In Cankaya, S. & Kibaroglu, M. (Eds.). *Bioterrorism: Threats and deterrents*. Washington, DC: IOS Press. doi: 10.3233/978-1-60750-501-3-45

Keranen, L. (2011). Concocting viral apocalypse: Catastrophic risk and the production of bio(in)security. *Western Journal of Communication, 75*(5), 451–472. doi: 10.1080/10570314.2011.614507

Khan, A. (2011). Public health preparedness and response in the USA since 9/11: A national health security imperative. *The Lancet, 378*(9794), 953-956. doi: 10.1016/S0140-6736(11)61263-4

Khan, Y., Fazli, G., Henry, B., De Villa, E., Tsamis, C., Grant, M. & Schwartz, B. (2015). The evidence base of primary research in public health emergency preparedness: a scoping review and stakeholder consultation. *BMC Public Health, 15*,432. doi: 10.1186/s12889-015-1750-1

Kingdon, J. W. (1984). *Agendas, Alternatives, and Public Policies*. Boston: Little Brown

Klein, K., Burkle, F., Swienton, S., King, R., Lehman, T. and North, C. (2016). Qualitative analysis of surveyed emergency responders and the identified factors that affect first stage of primary triage decision-making of mass casualty incidents. *PLoS Current, 19*(8). doi: 10.1371/currents.dis.d69dafcfb3ad8be88b3e655bd38fba84

Knaggård, A. (2015). Theoretically refining the multiple streams framework: The multiple streams framework and the problem broker. *European Journal of Political Research, 54*(), 450–465. doi: 10.1111/1475-6765.1209

Koenig, K. (2013). Adventures in disaster medicine: A United States experience that illustrates key public health policy principles. *Journal of Acute Medicine, 3*(4), 119-124. doi. 10.1016/j.jacme.2013.07.001

Kornbluh, M. (2015). Combatting challenges to establishing trustworthiness in qualitative research. *Qualitative Research in Psychology, 12*(4), 397–414. doi: 10.1080/14780887.2015.1021941

Kozleski, E. (2017). The uses of qualitative research: Powerful methods to inform evidence-based practice in education. *Research & Practice for Persons with Severe Disabilities, 42*(1), 19 - 32. doi: 10.1177/1540796916683710

LaFree, G. & Bersani, B. (2014). County-level correlates of terrorist attacks in the United States. *Criminology & Public Policy*, 13(3). 455-481. doi:10.1111/1745-9133.12092.

Lall, R., Abdelnabi, J., Ngai, S., Parton, H., Saunders, K., Sell, J., . . . Mathes, R. (2017). Advancing the use of emergency department syndromic surveillance data, New York City, 2012-2016. *Public Health Reports*, *132*(1), 23-30. doi: 10.1177/0033354917711183

Larkin, P. (2012). John Kingdon's "Three Streams" theory and the antiterrorism and effective Death Penalty Act of 1996. *Journal of Law and Politics*, XXV111(25), 25-50. Retrieved from www.lawandpolitics.org/

Leach, M. & Scoones, I. (2013). The social and political lives of zoonotic disease models: Narratives, science and policy. *Social Science and Medicine*, 88, 10-17. Retrieved from doi: 10.1016/j.socscimed.2013.03.017

Leuffen, D., Shikano, S., & Walter, S. (2013). Measurement and data aggregation in small-n social scientific research. *European Political Science: EPS*, *12*(1), 40-51. doi: 10.1057/eps.2012.8

Leung, L. (2015). Validity, reliability, and generalizability in qualitative research. *Journal of Family Medicine & Primary Care*, 4(3), 324-327. doi: 10.4103/2249-4863.161306

Li et al. (2017). Epidemiology of Human Anthrax in China, 1955–2014. In P. Drotman (Ed.), *Emerging infectious diseases* (pp. 14 – 21). Centers for Disease Control and Prevention, 23(1). Retrieved from https://wwwnc.cdc.gov

Lin, Y. (2013). The effects of job involvement on emergency medical technicians in Taiwan's fire organization. *Safety Science*, 59, 227-236. doi: 10.1016/j.ssci.2012.05.017

Lipsitch, M. & Bloom, B. (2012). Rethinking biosafety in research on potential pandemic pathogens. *mBio*, 3(5), 1-3. doi: 10.1128/mBio.00360-12.

Lohmus, M., Janse, I., Goot, F. & Rotterdam, B. (2013). Rodents as potential couriers for bioterrorismagents. *Biosecurity and Bioterrorism: Biodefense Strategy, Practice, and Science*, 11(1). doi: 10.1089/bsp.2012.0085

Lurie, N., Manolio, T., Patterson, A., Collins, F., &, Frieden, T. (2013). Research as a part of public health emergency response. *New England Journal of Medicine*, 368 (13),1251-1255. doi: 10.1056/NEJMsb1209510

Mabuza, L., Govender, I., Ogunganjo, G., & Mash., B. (2014). African primary care research: Qualitative data analysis and writing results. *African Journal of Primary Health Care & Family Medicine*, 6(1), 1-5. doi: 10.4102/phcfm.v6i1.640

MacIntyre, R. (2015). Biopreparedness in the age of genetically engineered pathogens and open access science: An urgent need for a paradigm shift. *Military Medicine*, 180(9). 943-949. doi: 10.7205/MILMED-D-14-00482.

Malet, D. & Korbitz, M. (2015). Bioterrorism and local agency preparedness: results from an experimental study in risk communication. *Homeland Security &*

Emergency Management, 12(4), 861–87. doi: 10.1515/jhsem-2014-010.

Maras, M. & Miranda, M. (2016) The weaponization of Ebola: A new risk in the wake of an outbreak? *Comparative Strategy*, 35(1), 72-79. doi:10.1080/01495933.2016.1134000

Markenson, D., Reilly, M., & and DiMaggio, C. (2005). Public health department training of emergency medical technicians for bioterrorism and public health emergencies: Results of a national assessment. *Journal of Public Health Management Practice*, 11(6), S68 - S74. Retrieved from https:// journals.lww.com/jphmp/

Markowitz, G. & Rosner, D (2004). Emergency preparedness, bioterrorism, and the states: The first two years after September 11. Milbank Memorial Fund. Retrieved from www.aha.org/

Marston, C., Allen, C., Beaudry, J., Price, E., Wolken, S., Pearson, T., Keim, P., & Hoffmaster, A. (2011). Molecular epidemiology of anthrax cases associated with recreational use of animal hides and yarn in the United States**.** *PLoS ONE*, 6(12), 1-7. 7. doi: 10.1371/journal.pone.0028274.

Matthew, M., Huberman, M. & Saldana, J. (2014). Qualitative data analysis: A methods sourcebook (3rd Ed). Sage Publications, Inc. Washington D.C.

Maxwell, J. (2013). *Qualitative research design: An interactive approach* (3rd Ed.). SAGE Publications, Inc. Thousand Oaks, CA

May, P., Jochim, A. and Sapotichne, J. (2011). Constructing homeland security: An anemic policy regime. *The Policy Studies Journal*, 39(2). doi: 10.1111/j.1541-

0072.2011.00408.x

McConnell, A. (2016). A public policy approach to understanding the nature and causes of foreign policy failure. *Journal of European Public Policy*, 23(5), 667-684. doi: 10.1080/13501763.2015.1127278

Mehraban, M., Hassanpour, M., Yazdannik, A., & Ajami, S. (2013). Technology concept in the view of Iranian nurses. *Iranian Journal of Nursing & Midwifery Research, 18*(3), 202 – 207. Retrieved from https://www.ncbi.nlm.nih.gov

Menrath, A., Tomuzia, K., Frentzel, H., Braeunig, J. & Appel, B. (2014). Survey of systems for comparative ranking of agents that pose a bio-terroristic threat. *Zoonoses & Public Health*, 61(3), 157-166. doi: 10.1111/zph.12065.

Méthot, P. (2015). Science and science policy: Regulating "select agents"in the age of synthetic biology. *Perspectives on Science*, 23(3), 280-309. doi: 10.1162/POSC_a_00173.

Mok, E., Lau, K., Lai, T. & Ching, S. (2012). The meaning of life intervention for patients with advanced-stage cancer: Development and pilot study. *Oncology Nursing Forum*, 39(6), 480-488. doi: 10.1188/12.ONF.E480-E488.

Monroe, J. (2014). Ebola and bioterrorism. The Ohio State University: Selected works of Joshua Monroe. Retrieved from https://works.bepress.com/joshua_monroe/2/

Monson, S. (2017). Ebola as African: American Media Discourses of Panic and Otherization. *Africa Today*, 63(3), 3-27. doi: 10.2979/africatoday.63.3.02

Moon, K., Brewer, T., Januchowski-Hartley, S., Adams, V. & Blackman, D. (2016). A guideline to improve qualitative social science publishing in ecology and

conservation journals. *Ecology and Society*, 21(3), 133-152. doi: 10.5751/ES-08663-210317.

Morris, N. (2015). Target suitability and terrorism events at places. *Criminology & Public Policy*, 14(2), 417-426. doi: 10.1111/1745-9133.12122.

Morse, J. (2015). Critical analysis of strategies for determining rigor in qualitative inquiry. *Qualitative Health Research*, 25(9) 1212 –1222. doi: 10.1177/1049732315588501

Munn, Z., Porritt, K., Lockwood, C., Aromataris, E. & Pearson, A. (2014). Establishing confidence in the output of qualitative research synthesis: The conQual approach. *BMC Medical Research Methodology*, 14(1), 108-114. doi: 10.1186/1471-2288-14-108

Murali, P., Ordóñez, F., and Dessouky, M. (2012). Facility location under demand uncertainty: Response to a large-scale bio-terror attack. *Socio-Economic Planning Sciences*, 46(1), 78-87. doi: 10.1016/j.seps.2011.09.001

Musheke, M., Merten, S., & Bond, V. (2016). Why do marital partners of people living with HIV not test for HIV? A qualitative study in Lusaka, Zambia. *BMC Public Health*, 16(882), 2-13. doi: 10.1186/s12889-016-3396-z

National Registry of Emergency Medical Technicians (2017). Advanced emergency medical technicians. Retrieved from https://www.nremt.org/rwd/public/document/advancedemt

National Science and Technology Council Committee on Homeland and National Security (2011). A national strategy for CBRNE standards. Retrieved from

https://obamawhitehouse.archives.gov/

National Threat Initiative, (2015). The biological threat: Germs don't respect borders, so biological threats – manmade and naturally occurring – can quickly have global inpacts. Retrieved from https://www.nti.org/learn/biological/

Navarro, J. & Villaverde, J. (2014). The future of counter-terrorism in Europe. The need to be lost in the correct direction. *European Journal of Futures Research*, 2(1), 1-12. doi: 10.1007/s40309-014-0050-9

Nemane, V. (2012). Food and agricultural security strategy and its implementation under the public health security and bioterrorism preparedness and response act of 2002. *Journal of Food Law & Policy,* 8(2), 317-345. Retrieved from http://heinonline.org

New Jersey Department of Health (2014). Ebola. Retrieved on from http://www.nj.gov/health/cd/

New Jersey Department of Health (2017). New Jersey EMS Agencies. Retrieved from http://www.nj.gov/health/ems

New Jersey Medical Reserve Corps (2004). Why does New Jersey need volunteers? Retrieved from https://njmrc.nj.gov/hcpr/

New Jersey Office of Emergency Management (n.d) Plan and prepare: Terrorism – basic family preparedness. Retrieved from http://ready.nj.gov/plan-prepare/terrorism.shtml

New Jersey Office of Emergency Medical Services (2016). Office of emergency services. Retrieved from http://www.state.nj.us/health/ems/

New Jersey Office of Emergency Medical Services (2017). Office of emergency services. Retrieved from http://www.state.nj.us/health/ems/index.shtml

Noble, H. & Smith, J. (2015). Issues of validity and reliability in qualitative research. *Evidence Based Nursing, 18*(2), 34 - 35. doi: 10.1136/eb-2015-102054.

O'Brien, K., Higdon, M., & Halverson, J. (2003). Recognition and management of bioterrorism infections. *American Family Physician*, 67(9), p. 1927-1934. Retrieved from http://www.aafp.org/afp/2003/0501/p1927.html

Oladimeji et al. (2015). Ebola virus disease - gaps in knowledge and practice among healthcare workers in Lagos, August 2014. *Tropical Medicine and International Health*, 20(9), 1162-1170. doi:10.1111/tmi.12528

Olliaro, P., Horby, P. & Torreele, E. (2015). Health security and rights in times of emerging health threats: towards a new way of doing essential health research and development. In D. Heymann et al., *Global health security: the wider lessons from the West African Ebola virus disease epidemic tension between freedom of research and national security*. *Public Policy*, 385, 1884-1901.doi: 10.1016/S0140-6736(15)60858-3

Olsen, M. (2013). Use of Medical Simulation to teach bioterrorism preparedness: The Anthrax Example. *Southern Medical Journal*, 106)1), 49-54. doi: 10.1097/SMJ.0b013e31827c505f

Olson, D., Scheller, A., Larson, S., Lindeke, L. and Edwardson, S. (2010). Using gaming simulation to evaluate bioterrorism and emergency readiness education. *Public Health Reports*, 125(3), 468-477. doi: 10.1177/003335491012500316

Olson, D., Scheller, A. & Wey, A. (2014). Using gaming simulation to evaluate bioterrorism and emergency readiness training. *Journal of public health management and practice*, 20(5), 52-60. doi: 10.1097/PHH.0000000000000080

O'Reilly, M. & Parker, N. (2013). 'Unsatisfactory Saturation': a critical exploration of the notion of saturated sample sizes in qualitative research. *Qualitative Research*. 13(2), 190 – 197. doi: 10.1177/1468794112446106

Oye, C., Sorensen, N. & Glasdam, S. (2016). Qualitative research ethics on the spot: Not only on the desktop. *Nursing Ethics*, 23(4), 455-464. doi: 10.1177/0969733014567023

Ózsvári, L., Kasza, G. & Lakner, Z. (2015). The history and importance of bioterrorism. 481-487. doi: 10.17626/dBEM.ICoM.P00.2015.p088

Palinkas, L., Horwitz, S., Green, C., Wisdom, J., Duan, N., & Hoagwood, K. (2015). Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. Administration of Policy and Mental Health, 42(5), 533–544. doi: 10.1007/s10488-013-0528-y

Pandey, C. L. (2019). Making communities disaster resilient. *Disaster Prevention & Management*, 28(1), 106–118. doi: 10.1108/DPM-05-2018-0156

Passi, D., Sharma, S., Dutta, S., Dudeja, P. & Sharma, V. (2015). Ebola virus disease (The killer virus): Another threat to humans and bioterrorism: Brief review and recent updates. *Journal of Clinical & Diagnostic Research*, 9(6), 1-9. doi: 10.7860/JCDR/2015/13062.6100

Patidar, M., Singh, A., Jaiswal, R., Chaudhary, S. & Samadi, F. et al. (2013).

Counteracting bioterrorism: A challenge to India. *Indian Journal of Forensic Medicine & Toxicology*, 17(2), 36-41. doi: 10.5958/j.0973-9130.7.2.008

Patton, M. (2002). *Qualitative Research & Evaluation Methods* (3rd Ed.). Thousand Oaks, CA: SAGE Publications, Inc.

Pedraza, J. (2012). The need to establish the Organisation for the Prohibition of Biological Weapons: A proposal for the future. *Public Organization Review*, 12(), 57-70. doi: 10.1007/s11115-011-0156-5

Petersen, B., Damon, I., Pertowski, C., Meaney-Delman, D., Guarnizo, J., Beigi, R., … Willoughby, R. (2015). Clinical guidance for smallpox vaccine use in a postevent vaccination program. MMWR Recommendations & Reports, 64(2), 1-29. Retrieved from https://www.cdc.gov/

Petrova, E., Dewing, J. & Camilleri, M. (2016). Confidentiality in participatory research: Challenges from one study. *Nursing Ethics*, 23(4) 442–454. doi: 10.1177/0969733014564909

Pinto, V. (2013). Bioterrorism: Health sector alertness. *Journal of Natural Science, Biology and Medicine*, 4(1), 24-28. doi: 10.4103/0976-9668.107256

Plough, A., Fielding, J., Chandra, A., Williams, M., Eisenman, D., Wells, K., Law, G., Fogleman, S. and Magaña, A. (2013). Building community disaster resilience: Perspectives from a large urban county Department of Public Health. *American Journal of Public Health*, 103(7), 1190-1197. doi: 10.2105/AJPH.2013.301268

Poland. G., Jacobson., R., Tilburt, J. and Nichol, K. (2009). The social, political, ethical, and economic aspects of biodefense vaccines. *Vaccines*, 27(4), 23-27. doi:

10.1016/j.vaccine.2009.08.054

Postholm, M. and Skrøvset, S. (2013). The researcher reflecting on her own role during action research. *Educational Action Research*, 21(4), 506-518. doi: 10.1080/09650792.2013.83379

Potter, M., Brown, S., Lee, BMD., Grefenstette, J., Keane, C., Lin, C., Quinn, S., Stebbins, S., Sweeney, P. & Burke, D. (2012). Preparedness for pandemics: does variation among states affect the nation ? *Journal of Public Health Management Practice*, 18(3), 233-240. doi: 10.1097/PHH.0b013e3182295138

Powell, T., Hanfling, D. & Gostin, L. (2012). Emergency preparedness and public health: the lessons of Hurricane Sandy. *Journal of the American Medical Association*, 308(24), 2569-2570. doi:10.1001/jama.2012.108940

Ramakrishna, K. (2014). Terrorism trends and challenges: understanding the emergence of ‘al qaeda galaxy. *The Journal of Defence and Security*, 5(1), 1-7.

Rapport, V., Clement, C., Doel, M. & Hutchings, H. (2015). Qualitative research and its methods in epilepsy: Contributing to an understanding of patients lived experiences of the disease. *Epilepsy & Behavior*, 45() 94–100. doi: 10.1016/j.yebeh.2015.01.040

Revere, D., Nelson, K., Thiede, H., Duchin, J., Stergachis, A. and Baseman, J. (2011). Public health emergency preparedness and response communications with health care providers: A literature review. *BMC Public Health*, 11(337) 1-8. doi: 10.1186/1471-2458-11-337

Richards, E. (2010). The United States smallpox bioterrorism preparedness plan: Rational

response or potemkin planning? *William Mitchell Law Review*, 36(5), 5179-5230. Retrieved from biotech.law.lsu.edu

Rickles, A. & Catarious, E. (2015). Assessing U.S. community preparedness in the case of Ebola virus disease: Using pandemic planning for the EVD response. *Obsidian Analysis*. Retrieved from http://docplayer.net/25767612-Assessing-u-s-community-preparedness-in-the-case-of-ebola-virus-disease.html

Roberts, L. (2015). Ethical issues in conducting qualitative research in online communities. *Qualitative Research in Psychology*, 12(3), 314-325. doi: 10.1080/14780887.2015.1008909

Roberts, L., Breen, L. & Symes, M. (2013). Teaching computer-assisted qualitative data analysis to a large cohort of undergraduate students. *International Journal of Research & Method in Education*, 36(3), 279-294. doi: 10.1080/1743727X.2013.804501

Robinson, O. (2014). Sampling in interview-based qualitative research: A theoretical and practical guide. *Qualitative Research in Psychology*, 11(1), 25–41. doi: 10.1080/14780887.2013.801543

Roche, B. & Hefferon, K. (2013). 'The assessment needs to go hand-in-hand with the debriefing': The importance of a structured coaching debriefing in understanding and applying a positive psychology strengths assessment. *International Coaching Psychology Review*, 8(1), 20-34. Retrieved from roar.uel.ac.uk

Rokach, A., Cohen, R., Shapira, N., Einav, S., Mandibura, A. & Bar-Dayan, Y. (2010). Preparedness for anthrax attack: the effect of knowledge on the willingness to

treat patients. *Disasters*, 34(3), 637-643. doi: 10.1111/j.0361-3666.2010. 01161.x

Rosoff, H., Siko, R., John, R., & Burns, W. (2013). Should I stay or should I go? An experimental study of health and economic government policies following a severe biological agent release. *Environment Systems & Decisions*, *33*(1), 121-137. doi:10.1007/s10669-012-9431-4

Rowley, J. (2012) "Conducting research interviews", *Management Research Review, 35*(3/4), 260 – 271. doi: 10.1108/01409171211210154

Rudestam, K. & Newton, R. (2015). *Surviving your dissertation: A comprehensive guide to content and process* (4th Ed.). Thousand Oaks, CA: SAGE Publications, Inc.

Sabatier, P., & Weible, C. (2014). *Theories of the Policy Process* (3rd Ed.). Boulder, CO: Westview Press.

Sanders, C. (2013). Need to know vs. need to share: Information technology and the intersecting work of police, fire and paramedics. *Information, Communication & Society*, 17:4, 463-475. doi: 10.1080/1369118X.2014.891632

Sarah, C. (2016). Contagion! How can we combat the Ebola virus epidemic and prevent it from spreading in South Africa? *Transactions of the Royal Society of South Africa*, 71(2), 197-199. doi: 10.1080/0035919X.2016.1161107

Schilling et al. (2009). European concepts for the domestic transport of highly infectious patients. *Clinical Microbiological and Infectious*, 15(8), 727-733. doi: 10.1111/j.1469.0691.2009.02871. x

Schmid, G. & Kaufmann, K. (2002). Anthrax in Europe: Its epidemiology, clinical characteristics, and role in bioterrorism. *Clinical Microbiology & Infection, 8*(8),

479 – 488. Retrieved from www.clinicalmicrobiologyandinfection.com/

Schweitzer, D. (2016). When terrorism met the plague: How 9/11 affected the outbreak narrative. *Cinema Journal*, 56(1), 118-123. doi:10.1353/cj.2016.0057

Seiner, D., Colburn, H., Baird, C., Bartholomew, R., Straub, T., Victry, K., Hutchison, J., Valentine, N. & Bruckner-Lea, C. (2013) Evaluation of the film array system for detection of bacillus anthracis, francisella tularensis and yersinia pestis. *Journal of Applied Microbiology*, 114(4), 992—1000. doi:10.1111/jam.12107

Seiple, C. (1997). Consequence management: Domestic response to weapons of mass destruction. *Parameters*, 27(3), 119-134. Retrieved from http://ssi.armywarcollege.edu/pubs/parameters/

Shelton, S., Connor, K., Uscher-Pines, L., Pillemer, F., Mullikin, J. & Kellermann, A. (2012). Bioterrorism and biological threats dominate federal health security research: Other priorities get scant attention. *Health Affairs*, 31(12), 2755 – 2763. doi: 10.1377/hlthaff.2012.0311

Shultz, J., Baingana, F. & Neria, Y. (2015). The 2014 Ebola outbreak and mental health: Status and recommended response. *Journal of American Medical Association*, 313(6), 567-568. doi:10.1001/jama.2014.17934

Sinha, S. & Singh, J. (2016). Classification, causes, control measures and acts of bioterrorism. *International Journal of Applied Biology and Pharmaceutical Technology*, 7(2), 342-354. Retrieved from www.ijabpt.com/

Smith, J & Herber, O. (2015). Ethical issues experienced by mental health nurses in the administration of antipsychotic depot and long-acting intramuscular injections: A

qualitative study. *International Journal of Mental Health Nursing*, 24(3), 222–230. doi: 10.1111/inm.12105

Smith, C. & Hewison, A. (2012). Are nurses prepared to respond to bioterrorist attack: A narrative synthesis. *Journal of Advanced Nursing*, 68(12), 2597-2609. doi: 10.1111/J.1365-2648.2012.06061. x

Smith, J. & Noble, H. (2014). Bias in research. *Evidence-base Nursing*, 17(4), 100-101. doi: 10.1136/eb-2014-101946

Song, Y., Gong, J., Li, Y., Cui, T., Fang, L., & Cao, W. (2013). Crowd evacuation simulation for bioterrorism in micro-spatial environments based on virtual geographic environments. *Safety Science*, 53, 105-113. doi: 10.1016/j.ssci.2012.08.011

Southern Illinois University, School of Medicine (2017). Overview of potential agents of biological terrorism. Retrieved from https://www.siumed.edu/im/overview-potential-agents-biological-terrorism.html#threat

Spain, K., Clements, P., DeRanieri, J. & Holt, K. (2012). When disaster happens: emergency preparedness for nurse practitioners. *The Journal for Nurse Practitioners*, 8(1), 38–44. Retrieved from doi: 10.1016/j.nurpra.2011.07.024

Sprenkle, M., Griffith, J., Marinelli, W. & Boyer, A. et al. (2014). Lethal factor and anti-protective antigen IgG levels associated with Inhalation anthrax, Minnesota, USA. *Emerging Infectious Diseases*, 20(2), p. 310-314. Retrieved from doi: 10.3201/eid2002.13024

Staiti, A. B., Katz, A., & Hoadley, J. F. (2003). Has bioterrorism preparedness improved

public health?. *Issue brief (Center for Studying Health System Change)*, (65), 1-4.

Steed, C., Howe, L., Pruitt, R. & Sherrill, W. (2004). Integrating bioterrorism education into nursing school curricula. *Journal of Nursing Education*, 43(8), 362-367. doi: 10.3928/01484834-20040801-05

Stratton, S. (2014). Ebola: Who is responsible for the political failures? *Prehospital and Disaster Medicine*, 26(6), 553-554. doi: 10.1017/S1049023X14001307

Streatfield, S., Kushnir, N. & Yusibov, V. (2015). Plant-produced candidate countermeasures against emerging and reemerging infections and bioterror agents. *Plant Biotechnology Journal*, 13(), 1136–1159. doi: 10.1111/pbi.12475

Suk, J., Zmorzynska, A., Hunger, I., Biederbick, W., Sasse, J., Maidhof, H. & Semenza, J. (2011). Dual-use research and technological diffusion: Reconsidering the bioterrorism shreat spectrum. *PLoS Pathogen*, 7(1), 1-3. doi: 10.1371/journal.ppat.1001253

Sundqvist, B., Bengtsson, U., Wisselink, H., Peeters, B., Rotterdam, B., Kampert, E., Bereczky, S., Olsson, J., Bjorndal, A., Zini, S., Allix, S., & Knutsson. R. (2013). Harmonization of European laboratory response networks by implementing CWA 15793: Use of a gap analysis and an ‘‘Insider’’ exercise as tools. *Biosecurity and Bioterrorism: Biodefense Strategy, Practice, and Science*, 11(1), 36-44. doi: 10.1089/bsp.2013.0020

Suter, N. and Suter, P. (2014). What works? How does one know? Show me the data: A call for science-based home health evidence. *Home Health Care Management & Practice*, 26(3), 119-121. doi: 10.1177/1084822313518558

Sylvia, B. & Danita, A. (2013). Nurses' preparedness and perceived competence in managing disasters. *Journal of Nursing Scholarship, 45*(3), 281-287. doi: 10.1111/jnu.12029

Tambunan, U., Parikesit, A. & Saputro, L. (2014). Bioterrorism as a threat to humanity. Retrieved from http://clr.ui.ac.id/wp-content/uploads/2014/08/Artikel-Kuliah-Umum-Internasional-MIPA-UI-Prof.-Usman-Sumo-Friend-Tambunan.pdf

Taschner, M., Nannini, A., Laccetti, M. & Greene, M. (2016). Emergency preparedness policy and practice in Massachusetts hospitals: A case Study. *Workplace Health & Safety*, XX(X), 1-8. doi: 10.1177/2165079916659505

Tavakol, M. & Sandars, J. (2014). Quantitative and qualitative methods in medical education research: AMEE Guide No 90: Part I, *Medical Teacher*, 36:9, 746-756. doi: 10.3109/0142159X.2014.915298

Taylor, E. (2015). Communicable disease and homeland security: An assessment of the U.S. 2014 Ebola incident. *Journal of Homeland Security and Emergency Management*, 12(4): 775–79. doi: 10.1515/jhsem-2015-0044

Teckman, A. (2013). The bioterrorist threat of Ebola in East Africa and implications for global health and security. *Global Policy Essay*. Retrieved from www.globalpolicyjournal.com

Teusner, A. (2016). Insider research, validity issues, and the OHS professional: one person's journey. *International Journal of Social Research Methodology*, 19(1), 85–96. doi: 10.1080/13645579.2015.1019263

Thissen, M. (2014). Computer audio-recorded interviewing as a tool for survey research.

Social Science Computer Review, 32(1), 90-104. doi: 10.1177/0894439313500128

Thomas, D. (2017). Feedback from research participants: are member checks useful in qualitative research? *Qualitative Research in Psychology*, 14(1), 23-41. doi:10.1080/14780887.2016.1219435

Thompson, K. (2016). Airborne assassin: Why the official stockpiles of the smallpox virus must be destroyed. *Emory International Law Review*, 31(1), 167-195. Retrieved from http://law.emory.edu/academics/law-journals/index.html

Toomey, M. & Singleton, B. (2014). The post-9/11 "terrorism" discourse and its impact on nonstate actors: A comparative study of the LTTE and Hamas. *Asian Politics & Policy*, 6(2), 183-198. doi: 10.1111/aspp.12110

United States Congress *(2002).* Public Health Security and Bioterrorism Preparedness and Response Act of 2002. 116 STAT. 594, 107(188), 1-105. Retrieved from https://www.fda.gov/

United States Department of Labor – Occupational Safety and Health Administration (2004). Personal protective equipment. OSHA 3151-12R. Retrieved from https://www.osha.gov/

United States House of Representatives Committee on Science (2004). Bioterrorism preparedness: Peoples, tools, and systems for detecting and responding to a bioterrorist attack. Field hearing before the Committee on Science, House of Representatives, one hundred eighth congress, second session, May 3, 2004. 4.SCI 2:108-56. Retrieved from https://babel.hathitrust.org/

University of Iowa: Human Subject Office (n.d). A summary of the Belmont Report. Retrieved from https://hso.research.uiowa.edu/summary-belmont-report

Vaughn, P. & Turner, C. (2016). Decoding via Coding: Analyzing Qualitative Text Data Through Thematic Coding and Survey Methodologies. *Journal of Library Administration*, 56(1),41-51. doi: 10.1080/01930826.2015.1105035

Venkatesh, V., Brown, S. & Bala, H. (2013). Bridging the qualitative–quantitative divide: Guidelines for conducting mixed methods research in information systems. *MIS Quarterly*, 37(1), 21-54. Retrieved from http:// http://misq.org/

Waite, D. (2011). A Simple Card Trick: Teaching qualitative data analysis using a deck of playing cards. *Qualitative Inquiry*, 17(10), 982-985. doi: 10.1177/1077800411425154

Waldrop, D., Clemency, B., Maguin, E., & Lindstrom, H. (2014). Preparation for frontline end-of-life care: Exploring the perspectives of paramedics and emergency medical technicians. *Journal of Palliative Medicine*, 17(3). doi: 10.1089/jpm.2013.0442

Walhart, T. (2013). The application of Kingdom's multiple streams intraepithelial neoplasia. J*ournal of Advanced Nursing*, 69(11), 2413-2422. doi: 10.1111/jan.12108

Walker, N. & Whitty, C. (2015). Tackling emerging infections: clinical and public health lessons from the West African Ebola virus disease outbreak, 2014–2015. *Clinical Medicine*, 15(5), 457-460. doi: 10.7861/clinmedicine.15-5-457

Wang, Y., Luangkesorn, K. & Shuman, L. (2012). Modeling emergency medical

response to a mass casualty incident using agent-based simulation. *Socio-Economic Planning Sciences*, 46(4), 281-290. doi: 10.1016/j.seps.2012.07.002

Washington State Department of Health (2016). Emergency preparedness and response: Washington State doctrine for health and medical preparedness, response and recovery. Retrieved from https://www.doh.wa.gov/AboutUs/ProgramsandServices/EmergencyPreparednessandResponse

Weant, K., Bailey, A., Fleishaker, E. & Justice, S. (2014). Being prepared: Bioterrorism and mass prophylaxis: Part II. A*dvanced Emergency Nursing Journal*, 36(4), 307–317. doi: 10.1097/TME.0000000000000034

Whetzel, E., Walker-Cillo, G., Chan, G. and Trivett, J. (2013). Emergency nurse perceptions of individual and facility emergency preparedness. *Journal of Emergency Nursing*, 39(1), 46-52. doi: 10.1016/j.jen.2011.08.005

White, D., Oelke, N, & Friesen, S. (2012). Management of a large qualitative data set: Establishing trustworthiness of the data. *International Journal of Qualitative Methods*, 11(3), 244-258. doi: 10.1177/160940691201100305

White, G. Porter, M., Mazerolle, L. (2013). Terrorism risk, resilience and volatility: A comparison of terrorism patterns in three Southeast Asian Countries. *Journal of Quantitative Criminology*, 29(2), 295–320. doi: 10.1007/s10940-012-9181-y

WHO Ebola Response Team (2014). Ebola virus disease in West Africa: The first 9 Months of the epidemic and forward projections. *The New England Journal of Medicine*, 371(16), 1481-1495. doi: 10.1056/NEJMoa1411100

Whyte, E., Burke, A., White, E., & Moran, K. (2015). Career commitment of post-professional athletic training program graduates. *Journal of Athletic Training* (Allen Press)., 50 (4), 426-431. doi: 10.4085/1062-6050-49.3.69

Williams, J., Nocera, M., & Casteel, C. (2008). The effectiveness of disaster training for health care workers: A systematic review. *Annals of Emergency Medicine*, 52(3), 211-222. doi: 10.1016/j.annemergmed.2007.09.030

Wiwanitkit, V. (2014). Ebola virus infection: What should be known. *North American Journal of Medical Sciences*, 6(11), 549-552. doi: 10.4103/1947-2714.145458

Woith, W., Jenkins, S., Astroth, K. & Kennedy, J. (2014). Lessons learned from conducting qualitative research in a hospital. *Nurse Researcher*, 22(2), 40-43. doi: 10.7748/nr.22.2.40.e1280

Wurtz, N., Grobusch, M. & Raoult, D. (2014). Negative impact of laws regarding biosecurity and bioterrorism on real diseases. *Clinical Microbiology and Infection*, 20(6), 507–515. doi: 10.1111/1469-0691.12709

Zeighami, R., Oskouie, F., & Joolaee, S. (2014). Discovering the barriers to spread the usage of peripherally inserted central venous catheters in the neonatal intensive care units: A qualitative research. *Bangladesh Journal of Medical Science, 13*(4), 449 - 453. doi: 10.3329/bjms.v13i4.12989

Zhang, P., Liu, X., Wang, C., Zhao, Y., Hua, F., Li, C., Yang, R. & Zhou, L. (2014). Evaluation of up-converting phosphor technology-based lateral flow strips for rapid detection of bacillus anthracis spore, brucella spp., and yersinia pestis. *PLoS ONE*, 9(8), 1-12. doi: 10.1371/journal.pone.0105305

Appendix A: Cover Letter

August 13, 2017.

Dear_____

My name is Ndubuisi Ejike, and I am a doctoral student in the School of Public Policy and Administration (PPA) at Walden University. My area of concentration is Terrorism, Mediation, and Peace (TMP). My dissertation topic is *Bioterrorism Hardening: An Exploratory Study of EMTs Preparedness and Practices.* The purpose of the research is to examine and understand the bioterrorism preparedness and emergency response practices (BT/ERPs) among emergency medical technicians (EMTs). The study has the approval of the Walden University Institutional Review Board (IRB).

I am inviting you to participate in the study because you met the selection criteria that include a minimum of five-year work experience as an EMT and employment since the 2014 Ebola epidemic. Although there is no benefit for participating in the interview, your participation will help improve the bioterrorism preparedness and emergency readiness of EMTs in your county and community-wide readiness practices during disease epidemic. There is also no known risk for participating in the research. Participating in this interview is voluntary, and you may withdraw at any stage of the interview process. Also, if you want to make an anonymous complaint about the manner of the interview or you need additional verification, you may contact my Dissertation

Committee Chairman. After the interview and you need any further clarification, you may contact me.

The interview is estimated to last for one hour. The interview will be conducted in in a public library conference or any other available secured room or space for your safety and privacy. You may choose any time during library hours between 10.30 am and 7.30 pm during workdays and at a time most suitable for you that will not disrupt your work schedule. The interview will be audio-recorded.

I appreciate your taking the time to assist me in this research. The information you provide will be used only for the study and destroyed five years after the conclusion of the study and graduation as required by the University IRB. In addition, all personal information collected will be treated with utmost confidentiality, and I will destroy them in accordance with the University IRB requirement.

Thank you.

Sincerely,

Ndubuisi C. Ejike (Researcher)

Prof. George Kieh (Dissertation committee chairman)

Appendix B: Participants' Demographic Information

I will administer the demographic survey orally to each research participant. The survey is to ensure that participants meet the requirements to be eligible for participation in the interview. The requirements include a minimum age of 25, minimum of five years of professional experience, and employment during the 2014 Ebola epidemic. This survey will help me collect data about bioterrorism and emergency readiness (BT/ER) in your county vis-a-vis bioagent knowledge and training. The information gathered will be for this study only.

1. Please indicate what area of emergency response you specialize on.

(a) Emergency medical technicians

(b) Paramedics

(c) Mobile intensive care nurses

(d) Advanced emergency medical technician

(e) Others (please indicate)

2. How long have you been employed in emergency medical response?

(a) Under 4 years

(b) 4 -10 years

(c) 10 - 15 years

(d) 15 - 15 years

3. Were you actively employed during the 2014 Ebola epidemic?

Circle one: Yes or No

4. In what category is your age?

(a) Under 24

(b) 24 - 29

(c) 30 - 35

(d) 36 - 41

(e) Above 42

5. Please specify your race.

(a) African American

(b) Caucasian

(c) Hispanic

(d) Other. Please indicate:

6. Indicate your educational attainment.

(a) Certificate

(b) GED

(c) University Education: Bachelors

(d) University Education: Above Bachelors

7. Indicate your gender.

(a) Male

(b) Female

Appendix C: Interview Questions

Research Topic: Interview Guide on Bioterrorism Hardening: An Exploratory Study of EMTs Preparedness and Practices.

Introduction: The following questions will be used to examine and understand the emergency preparedness and practices among emergency medical workers especially when it involved bioterrorism. The findings should help increase EMTs' knowledge of biological agents, their characteristics, and their overall bioterrorism preparedness readiness and response practices. This proposed study is germane following the inadequate emergency responses during the 2014 Ebola epidemic.

Background

Interviewer:

Interviewee Name:

Address:

City, state: zip:

Telephone: home ( ) _____ Work ( ) _____

Sex: Female or Male (circle)

What is your current position in your organization?

Research Questions:

1. How would you describe the existing emergency response practices in your organization?

2. How would you describe the preparedness practices in your organization for biological attacks especially after the 2014 Ebola epidemic?

3. How will the knowledge of bioagents help you in emergency responses that involve cutaneous diseases?

4. What knowledge do you have about cutaneous forms of pathogens such as Ebola?

5. How do your emergency response protocols prepare you for potential bioagent or biological attacks?

6. What kind of preparedness and training do you need for disaster response?

7. What areas of training or tools do you think you will need for effective bioterrorism and emergency response?

8. What other suggestion would you proffer for adequate bioterrorism and infectious disease response by emergency medical response?

9. What would you say are the major obstacles for an effective emergency response involving infectious diseases?

10. What policy changes do you think can make your emergency response safer?

Appendix D: Gatekeeper Information Form

Topic: *Bioterrorism Harding: An Exploratory Study of Emergency Medical Technicians Bioterrorism preparedness practices and policies*

Introduction:

I am Ndubuisi Ejike. I am a student at the Walden University and conducting a study in partial fulfillment of the requirement for the degree of Doctor of Philosophy. The research is on the bioterrorism preparedness and practices of emergency medical technicians (EMTs). I am requesting your permission to interview emergency medical workers in your organization. With your permission, I will interview them in your organization to avoid interrupting your organizational workflow.

I am requesting your assistance in identifying and selecting emergency workers who have theoretical and practical experiences in emergency response for the study. I have itemized some information about the study that will help you in the selection process. They include the reason for the study, eligibility requirement, and how the study will be conducted.

The rationale for the Study:

The purpose of the study is to examine the bioterrorism and emergency response practices (BT/ERPs) in your organization and help increase EMTs bioagent knowledge and improve EMTs BT/ERPs' readiness given the heightened terrorism threats and the higher risk EMTs face. The study's findings will help in identifying the areas of improvement in EMTs response and patients' handling during cutaneous disease epidemic and/or bioterrorism incidents.

How and Where I need your assistance

I will need your assistance in identifying and selecting participants who met the selection criteria. I will need five research participants. The criteria for eligibility for participation in the study are a minimum age of 25; minimum work experience of five; and the participant must have been employed/volunteered during the 2014 Ebola epidemic. Please provide me the names, phone numbers and email addresses of the participants who meet the requirements for me to contact them. You will also assist me in identifying the areas the interview might take place with the least disruption to your daily workflow.

The Role of the Research Participant

I will give the selected participants the informed consent form that will the state the purpose of the study. The interview is estimated to last one hour. The interview will take place during office hours from 10.30 pm to 4.30 pm. Participation will be voluntary, and they will not be paid. There is no known risk participating in this study. However, participants have the right to withdraw at any time throughout the interview stages. The research questions will center on EMTs' knowledge of bioagents; knowledge of bioterrorism preparedness and practices; willingness to respond in the event of infectious diseases epidemic and/or bioterrorism.

Safeguarding Confidential Information

All research materials and data collected will be treated with utmost confidentiality. Participants name and your organization name and information will be protected and not identified by actual names. Each participant will be assigned identities

using alphabets. For instance: participant A; participant B; participant C and so on. Similarly, your organization will not be identified by name. I will categorize participating organizations as follows: Emergency Agency 1; Emergency Agency 2; Emergency Agency 3 and so on. Besides me, the other persons who will access to the data are two members of my dissertation committee. Please find the names of my dissertation committee members:

Prof. George Kieh

Dr. Michael Brewer

After the study, I will make available a copy of the findings to your organization. Please provide me with your contact information for follow up calls and future assistance. I truly appreciate your assistance. Feel free to contact me at any time if you have any question or need further clarification.

Thank you for your assistance.

Sincerely,

Ndubuisi Ejike

Appendix E: Consent and Authorization Form

1. I _____ voluntarily give my consent to assist the execution of this research study.

2. I have read and retained a copy of the cover letter detailing the purpose of the study and areas I will be required to assist the researcher: Mr. Ndubuisi Ejike.
3. As stated I the cover letter, my roles will be to facilitate Mr. Ejike gaining access to both the organization and the research participants; assist in identifying those EMTs who are more knowledgeable and experienced and were employed during the 2014 Ebola epidemic; and assist in locating a conducive area in the work place that will not negatively impact the work activities.
4. Despite my signing of this agreement, I reserve the right to withdraw my assistance at any time throughout the duration of the research study without any consequences.
5. All information gathered through the participants or observed by the Mr. Ejike will treated with utmost confidentiality and all participants names and the name of the organization kept anonymous.
6. I understand that the research participants will be given the informed consent form before participating in the study.
7. I have the right to, at any time, seek clarifications and ask questions if necessary to protect my organization.

Signature of Gatekeeper & Date:

_____

Name and Signature of Researcher & Date:

_____